THE MEDICAL JOURNAL OF AUSTRALIA

VOL. I.—12TH YEAR. SYDNEY: SATURDAY, JANUARY 10, 1925. No. 2.

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A CONTRIBUTION TO THE DISCUSSION OF THE HISTOLOGICAL PROBLEMS INVOLVED IN THE CONCEPTION OF A SOMATIC AND SYMPATHETIC INNERVATION OF VOLUNTARY MUSCLE.

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THE problem of the double innervation, somatic and sympathetic, of striated muscle has received attention from two groups of investigators within the last fifteen years. Histologists, notably Boeke, introduced the conception and physiologists and clinicians have attempted to supply the meaning for this now generally accepted fact. In view of the contradictions still existing in the literature on the subject when dealt with from the histological standpoint, one of us (O.L.) undertook the investigation by means of the gold chloride technique of the material made available as a result of the experimental work of Royle[1] and Hunter.[2] The results of this investigation constitute the histological basis of the discussion of the problem of the double innervation of striated muscle which forms the subject of this paper. In 1879 Tchiriew[3] made the discovery that in snakes there were present not only motor endings *en plaque* with the usual familiar characters, but also *terminaisons en grappes*. Tchiriew described the *terminaisons en grappes* as being hypolemmal in character and he believed that the axis cylinders ramified in a granular substance like ordinary motor nerve fibres, though in some cases this was absent.

He recorded the presence of transitional forms between the usual type and the usual motor nerve endings and regarded the grape-like endings as immature forms of the latter into which they would when fully developed, become converted.

Tchiriew noticed the following important difference between the two types of endings. The ordinary motor endings were the terminations of medullated nerve fibres which preserved the medullary sheath up to or within a short distance of the muscle fibre. This interpretation of Tchiriew did not arouse great interest, for it did not imply any physiological difference between the two types of endings which were the terminations of medullated and non-medullated nerve fibres respectively.

Bremer[4] in 1882 confirmed the finding that non-medullated nerve fibres supplied striated muscle. He also described finely medullated fibres with which the non-medullated fibres were connected.

Although he observed transitional forms between the typical motor end-plates and the grape-like terminations of Tchiriew, which he described as being umbilliform in character, Bremer believed that they were so distinct that they represented specifically different types. He suggested that the *terminaisons en grappes* were sensory. Giocomini who studied these endings in reptiles, found them on muscle spindles as well as on ordinary muscle fibres and recorded them as sensory.[5] Perroncito[7] recorded that the same muscle fibre never receives both an ending *en plaque* and an ending *en grappe*. Since each muscle fibre must receive at least one motor ending, he concluded that the *terminaisons en grappes* must be motor. But Perroncito did not prove conclusively that he was not dealing altogether with collateral and ultra-terminal fibres of the medullated nerve fibres. Wilson has explained some of these appearances.[19] In another paper in 1902 Perroncito[8] claimed that his histological observations proved that striated muscle is innervated both by cerebro-spinal nerve fibres and sympathetic nerve fibres. He ascribed the non-medullated nerve fibres to the sympathetic system because he believed that they were connected with a perivascular nerve plexus. Botezat[9][10] in 1906 described the innervation of the striated muscles of birds by both medullated and non-medullated fibres. He recorded that the endings of the latter resemble motor endings. From 1909 onwards Boeke[11][13] has published his exhaustive investigations upon this subject in which he employed Bielchowski's technique and compared histological interpretation with experimental investigation. He described the non-medullated nerve fibres as being independent of the ordinary medullated fibres and referred to them as "accessory" fibres and their terminations as accessory nerve endings. He insisted on the hypolemmal character of the accessary terminations and emphasized the fact that though they may form independent end-plates on the muscle fibres, these endings were sometimes associated with the sarcoplasm of the typical motor end-plates. These facts were regarded by him as indicating the efferent nature of the "accessory" fibres and terminations. In 1913[12] he claimed that the "accessory" system was sympathetic or autonomic in character. Following up this conception he published the results of his experimental work in 1917[14] in which he attempted to dissociate the "accessory" from the cerebro-spinal system innervating the muscles of the eyeball. The experimental results in this field were difficult of interpretation and did not prove beyond question that Boeke's "accessory" system was sympathetic in origin for the following reasons.

After section of the trochlear nerves degeneration of the medullated fibres innervating the superior oblique muscles was observed in a few days (three to five), but the non-medullated were intact and apparently so numerous that each muscle fibre possessed at least one "accessory" nerve ending. But if a longer period such as three weeks was allowed to elapse prior to examining the muscle, the greater number of the non-medullated fibres were also found to have undergone degeneration. Obviously the majority of the "accessory" fibres had been severed with the trochlear nerve. The "accessory" fibres were probably conveyed to the nerve by way of the cervical sympathetic trunk during its course peripherally. Further removal of the superior cervical ganglion did not cause degeneration of the "accessory" fibres, though Boeke believed they were fewer in number.[13]

More convincing evidence that the "accessory" system is sympathetic is forthcoming from the experiments of Boeke and Dusser de Barenne[16] upon the innervation of the intercostal muscles of cats. Agduhr[17][18] obtained similar results from the experimental investigation of the interosseous muscles of the cat. Agduhr records two different experiments in his paper. In one series the *ganglion stellatim* of the sympathetic trunk was removed and in one specimen six days later the Bielchowski method revealed the fragments of degenerating non-medullated nerve fibres. In the second the appropriate spinal nerves were resected in the intervertebral foramina between the position of the spinal ganglion and the point of divergence of the white *ramus communicans*. From five to ten days later the animals were killed and Bielchowski preparations of the interossei muscles of the paws revealed that all the motor and sensory medullated nerves had degenerated. But Agduhr found many intact non-medullated nerves partly with bundles of spinal nerves and partly along vessels. Many of the non-medullated fibres were traceable to ordinary muscle fibres or the fibres of muscle spindles. Agduhr regarded the great majority of the end-organs as being hypolemmal in character. Some, however, were epilemmal in position. Agduhr found in the same muscle fibre a degenerated motor plate (somatic) and an undegenerated hypolemmal ending which he regarded as being sympathetic in origin. This observation confirms Boeke's[14] conclusions that the "accessory" system is sympathetic in origin, that the "accessory" plates are hypolemmal in character and that the same muscle fibre receives both somatic and sympathetic nerve endings.

This historic account claims to introduce the crucial problems still under discussion rather than to be a complete historical account of the contributions to the subject of the double innervation, somatic and sympathetic, of striated muscle. Professor J. T. Wilson[19] who reviewed the evidence available in 1919, concluded after examining the contributions of Boeke and Dusser de Barenne and Agduhr, "that these relationships, if admitted, would seem to indicate a centrifugal conduction along these fibre paths of nerve impulses, presumably of motor and possibly of tonic contractile character." In 1922 in Madrid Boeke[15] summarized the knowledge that had accumulated since Tchiriew's discovery in 1879 concerning the striated muscle of reptiles. He first discussed the exact structure of the *terminaisons en grappes* and concluded that they are hypolemmal in character. He figures some of his Bielchowski preparations in which the periterminal network is to be seen around

the ramifications of the neuro-fibrillæ. He admits, however, that the sarcoplasm is not heaped up around such terminations, although nuclei are present. He also points out that epilemmal endings which are sensory in character, sometimes resemble the *terminaisons en grappes* and, further, that non-medullated collaterals and ultra-terminal fibres which originate from medullated nerve fibres, are similarly difficult to distinguish in form from grape-like terminations. Ultra-terminal fibres run singly and not in bundles like the non-medullated fibres of the sympathetic system. In the present year Kulchitski[20] has reviewed the question of the double innervation of the striated muscles of reptiles in special reference to his work on the python. He employed the gold-chloride method only. His results are widely different in two important respects from the conception built up by the work of Boeke and others, which has already been reviewed. Finally he believes that the *terminaisons en grappes* lie outside the sarcolemma (epilemmally) and emphasizes the fact that the "medullated and the non-medullated fibres never terminate on the same muscle fibre."

He affirms that the non-medullated fibres form extensive plexuses and separate into considerable bundles which direct themselves towards the muscle fibres. In contradiction to this the medullated fibres leave their bundles singly and end by each fibre giving one plate to the muscle fibre on which it terminates. Using the same material as Kulchitski,[20] Dart[21] records that every individual muscle fibre receives both types of endings. This is not clearly shown in the figures to which reference is made. He claims that many of the so-called non-medullated fibres are "finely medullated" fibres. He regards the non-medullated fibres as sensory in character. He could not decide in his teased preparations whether or not the terminations were epilemmal in position.

In the following description the various points, some of them of fundamental importance, which are still at issue, will receive special attention:

1. The relationship of the termination of medullated and non-medullated nerve fibres to the individual muscle fibres to decide whether double innervation of each muscle fibre is present or not.

2. The characters of the non-medullated fibres, as collaterals of medullated fibres which may possibly be confused with sympathetic non-medullated fibres.

3. The mode of ending of sympathetic non-medullated fibres—whether hypolemmal, epilemmal or both.

4. The nature of the sheath of bundles of non-medullated fibres, with reference to the existence or not of finely medullated fibres.

5. The relation of the non-medullated nerve fibres to the blood vessels.

These points can perhaps best be approached by a simple description of the appearances in our slides of the microscopical preparations of striped muscle of the animals experimented on. But before commencing this we feel we ought to acknowledge our indebtedness to that recognized authority on neurological technique, Professor N. Kulchitski, whose distinguished services have lately been made available to the English speaking world by his association with the histological department of the Anatomy School, University College, London.

Dr. Royle[1] had reached certain conclusions on the function of the sympathetic system upon striped muscle from clinical and operative procedures on spastic patients; Dr. T. Potts had prepared some remarkable dissections of the sympathetic system on the cadaver and one of us (J.I.H.)[2] had likewise formulated certain theories partly from studying the literature on decerebrate rigidity and tonus and the sympathetic system from both clinical and histo-anatomical grounds, as well as from reactions observed in company with Royle during operative procedures on birds and goats. But no opportunity of personally seeing anything like a non-medullated nerve ending on striped muscle was given to any of them till a fine specimen of non-medullated nerve endings (the so-called *terminaisons en grappes*) on the striped muscle of python was presented by Kulchitski, personally prepared by himself by the gold impregnation method of Cohnheim and Ranvier. This evidence from the other end as it were of the line of investigation on sympathetic influence over striped muscle seemed to complete the links in the chain of their evidence and greatly heartened them in their investigations. It was with the idea of demonstrating similar non-medullated nerve endings in the striped muscle of the birls and animals (goats) made available by the munificence of a private benefactor (George H. Bosch, Esquire) that the following microscopical investigations were carried out.

Technique Employed.

Small pieces of muscle were taken from the limbs, intercostals, extrinsic (especially the *levator palpebræ*) and sometimes the intrinsic muscles of the eye of fowls, seagulls and goats. Some of the animals had died naturally; some of the specimens were gained soon after an operation; in some instances the animals were specially killed by an overdose of ether. It must be admitted that some of our best results were obtained from animals that died naturally even though the tissues were obtained as late as eighteen hours after death. Notwithstanding the proverbial irregularity of the results obtained by various gold impregnation methods, some of our failures to impregnate satisfactorily may have been due to the use of over-anæsthetized animals.[22] Minute pieces of muscle were prized off with broken glass to avoid contact with metal and all vessels cleaned with *aqua regia* and distilled water. Loewit's gold-chloride method was adopted with the use of gold sodium salt; generally about twenty times the amount of fluid to that of tissue was employed. Alcohol seemed to improve the result even if it was decided to tease in glycerine. The impregnated tissues were preserved in glycerine and sometimes were put through the alcohols and ether into celloidin and then soaked in dextrin solution and cut by the freezing method. These sections could be simply examined in glycerine or cleared in xylol-carbol and mounted in balsam. Our best

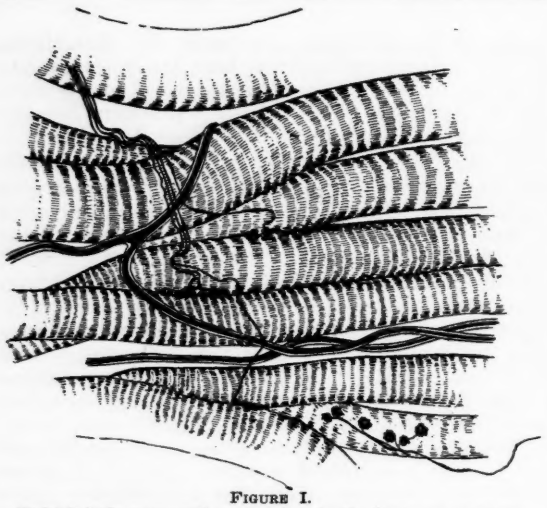

FIGURE I.
Kulchitsky's preparation showing *teminaisons en grappes* in python.

results being obtained with striped muscle fibres from the *levator palpebræ*, many preparations were made from this, but this muscle differs from our ordinary conception of "meat" in being exceedingly tough, the muscle fibres being apparently enclosed in a tough fibrous or areolar meshwork. Under gold treatment this might become a tough clear gristle, from which the muscle fibres had to be teased. Much more useful preparations showing leashes of nerve fibres proceeding to their terminations, were obtained when the gold or formic acid had macerated the tissues so that when mounted under a strong cover-glass in glycerine, a pressing or rolling motion on the cover-glass with a cork made the individual muscle fibres slip off each other in regular order leaving the nerve supply, myelinated or unmyelinated, clearly defined. The edges of the cover-glass were then painted with glycerine jelly and when dry gold size was painted over it. We cannot say why the *levator palpebræ* impregnated best unless the areolar matrix helped to differentiate the gold staining. Drawings were made from the microscopical appearances of the preparations; a Watson eight millimetre apochromatic lens and a Zeiss compensating × 18 eyepiece were used, which yielded a total magnification of about 360. A binocular microscope was substituted when difficulty was experienced in orientating different levels.

Description of the Slides.

Figure I. is one of Professor Kulchitski's teased glycerine mounted gold impregnated preparations of striped muscle of python.[1] In it may be readily made out delicate unmyelinated nerve fibres ending in grape-like terminations which in profile appear scarcely to touch the sarcolemma. He maintains that they are on the sarcolemma and are therefore epilemmal. The fine fibres and endings do not appear to bear any relation to the capillaries represented here as having a double contour, but to be solely associated with the striped muscle fibres.

[1] For the purpose of reproduction this and the succeeding diagrams have been reduced.

Unfortunately this preparation does not show any myelinated nerves with their coarse motor endings forming humps on muscle fibres (eminences of Doyère). Since the axis cylinder terminals pierce the sarcolemma, these are hypolemmal in position. Kulchitski draws attention to the characteristic way myelinated motor nerves approach the muscle fibres which we also observed in preparations from the goat and hen, while the non-myelinated (sympathetic ?) nucleated fine fibres form plexuses and proceed to their terminations (*en grappes*) after a long indirect course. This authority maintains that he has never seen both types of terminations (*engrappes* and *en plaques* of Doyère) from unmedullated and medullated nerve fibres respectively end on the same striated muscle fibre. At the same time he has not used Bielchowski's silver impregnation methods by which means other eminent investigators claim to have observed the opposite condition, namely both kinds ending on one fibre, near each other.

These grape-like terminations have no sole plate; they could not have, if they were epilemmal in position, because the sole plate is derived from a condensation of sarcoplasm beneath the sarcolemma. In muscle spindles (somatic sensory fibres, according to Sherrington), he continues, one always finds some non-medullated fibres with their numerous grape-like endings inside the encapsuled part of the muscle fibre, in contra-distinction to most investigators who describe them all as being placed outside.

Figure II. is the upper eyelid of a hen including the *levator palpebræ;* the specimen is a gold impregnation, thick celloidin section. A previous section of the cervical sympathetic had caused the typical drooping of the eyelid. At *B* a fairly thick nerve mostly composed of unmyelinated nerve fibres can be made out, giving off delicate branches, one of which divides and joins again and again dividing eventually proceeds to a delicate ending at *A* something like the *terminaisons en grappes* in the python

FIGURE II.
Unmyelinated plexiform nerve endings in striped muscle of hen.

and hardly consistent with Stefonelli's[15] and Dart's[21] closed peripheral nerve net. Many of the fibres branch and join other fibres to form plexuses and the fibrils show irregular thickenings perhaps due to metallic impregnation of part of the coverings of the axis cylinders (as at *C*). The terminations appear to follow the confines of the striated muscle fibres and not to end in the inter-muscular tissue; neither do they appear to bear any relation to the capillaries. This preparation does not allow one to affirm whether the endings are epi- or hypolemmal and all the muscle fibres depicted are distinctly of the striated variety.

Figure III. is an illustration of the *levator palpebræ* of a hen of the same series as the hen whose eyelid served for Figure II. At *A* it would appear as if the grape-like terminations were on the sarcolemma, only causing such an elevation as might be produced by their individual size and not associated with any eminence derived from the muscle itself.

Figure IV. represents the *levator palpebræ* of a hen of the same series. The section shows the extremely rich supply of these non-medullated nucleated fibres and peculiar endings to the striped muscle fibres. At *A* a leash of fine fibrils appears to encircle a bundle of striped muscle fibres and to give off terminal fibrils with characteristic grape-like endings.

Figure V. illustrates a few of the non-medullated (sympathetic ?) nerve fibrils, plexuses and grape-like endings (muscle fibres not always shown) to demonstrate common types. The magnification is about 800 diameters. It is from the same section as the last. At *A* the great extent of the nucleated non-medullated fibre with divisions at *B* before terminating at *E*, is seen. At *C* there is another group, while at *D* the appearance of the grape-like endings suggests an epilemmal position.

We have found considerable difficulty in getting these gold impregnations to take on a counter stain successfully, in order to enable us to decide whether these endings lie on or just beneath the sarcolemma. A knowledge of the physical properties of the sarcolemma would help. If it were tough so that it behaved somewhat like a leather apron over an object, then if it were over a nerve ending, any eminence caused by this nerve termination

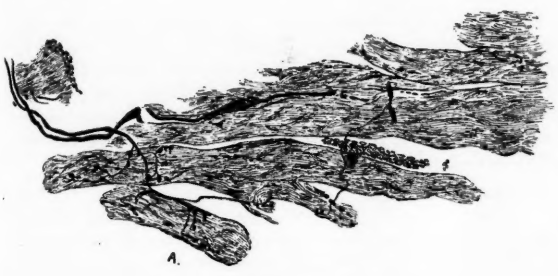

FIGURE III.
Unmyelinated nerve endings in *levator palpebræ* of hen.

FIGURE IV.
Numerous endings from nucleated nerves (celloidin preparation).

should be even in contour, such as appears in the case of the large somatic motor endings, the eminences of Doyère; whereas if the sarcolemma behaved like a delicate membrane like the peritoneum, it would be difficult to decide one way or the other when the individual discrete terminal buds appeared as discrete elevations apparently on the sarcolemma. In the sequel it will be shown these non-medullated endings at different times appear to answer both descriptions, either exhibiting discrete buds apparently on the sarcolemma or forming rounded eminences below it.

Figure VI. is a drawing of a longitudinal section of the wing muscle of a hen, impregnated with gold and imbedded in celloidin. At *A* a leash of unmyelinated nucleated fibres partly accompanying a blood vessel in the inter-muscular connective tissue between the muscle bundles breaks into a plexus and from this numerous fibrils end in the striated muscle fibres in the form of delicate maiden-hair fern-like terminations. Only a few of these lie near some capillaries from the larger blood vessels. We find that these leashes of nucleated nerves tend to approach the muscle bundles along or beside of a medium sized blood vessel and then when forming plexuses leave the vascular system and apply themselves to the muscle fibres. *B* is a continuation of *A* upwards, while at *C* the partial failure of the gold to impregnate the non-medullated fibres completely with the usual black deposit, allows one to see the nuclei closely applied to the axis cylinders in the manner typical of the sympathetic nerves. Some of these give off delicate fibrils ending in a characteristic manner on a muscle fibre which is striated. The nodes of Ranvier are absent from these nerves. This section therefore suggests that a plentiful supply of non-medullated nucleated nerves and nerve endings in the form of delicate maiden-hair fern, associate themselves with the striated muscle fibres of the wing of fowls.

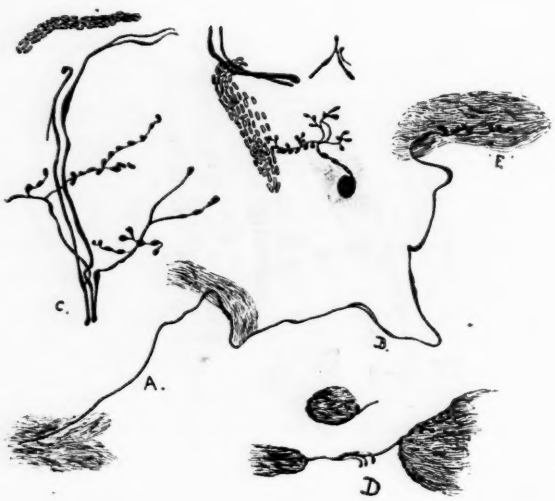

FIGURE V.
Some sympathetic (?) nerves and endings in fowl's striped muscle.

Figure VII. represents the wing muscle of a fowl, impregnated with gold, teased in glycerine and well macerated by the formic acid. The preparation allows one to note a bundle of non-medullated nerve fibres within a common sheath of Henle and whenever a branch is given off to a striated muscle fibre, a sheath of Henle is conspicuously provided right up to the termination in a manner at first sight resembling a myelinated fibre. Sometimes the endings are like a broad maiden-hair fern leaf or large bunch of grapes and sometimes one or two fibres run along a muscle fibre giving off minute buds. A blood vessel supplies the same muscle fibres, but the nerves and terminations do not appear to belong to it. They follow the contour of the muscle fibres more definitely. Kulchitski[20] depicts such a nerve ending with a conspicuous sheath of Henle and with a peripheral nerve cell. In medullated nerve fibres of the fowl the metallic penetration rarely proceeds further than a purple colour, while the non-medullated are often black; the somatic motor endings scarcely take the gold at all in our preparations. When they do, the motor nerve endings of the myelinated nerves are seen to be many times coarser and of larger and fewer individual elements.[10]

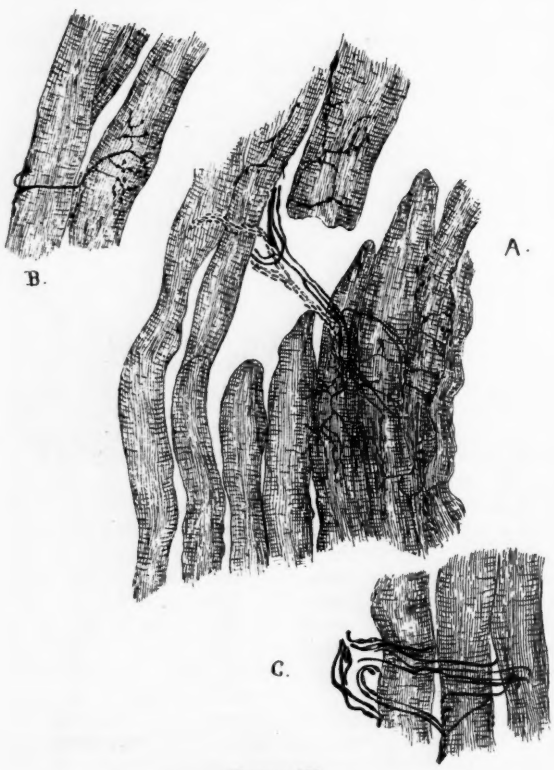

FIGURE VI.
Nerve endings from nucleated nerves, wing muscle of hen.

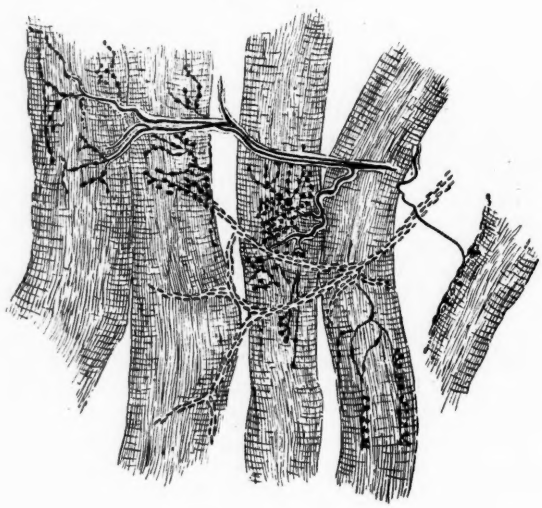

FIGURE VII.
Terminaisons en grappes, wing muscles of hen; teased.

Figure VIII. is from the same preparation as Figure VII.. It includes a coarsely myelinated motor ending in the hen's wing, striated muscle. At *A* a leash of coarse myelinated fibres (incorrectly coloured black) sends down myelinated fibres to the underlying striped muscle, one of the fibres terminating at *B* in a motor end-organ, evidently different from the delicate terminations traced to non-medullated nucleated nerves of the sympathetic system. At *C* a leash of unmyelinated nerve fibrils with a cross section, are put in for contrast.

Figure IX. is a drawing of a goat's *levator palpebræ,* teased in glycerine. This preparation shows coarse myelinated fibres *A* proceeding to end in striped muscle forming hypolemmal end-plates *B*, otherwise called eminences of Doyère or *terminaisons en plaques.* In some of these partial failure of the gold staining brings out some of the

nuclei of the sole plate. In their superficial position they may arise from the sheath of Schwann. When occupying positions as at *F* in Figure X, they are said to come from the granular substance.

The nuclei (Figure IX.) associated with these end-plates according to Ranvier, come from three sources: (i.) Nuclei of the granular substance, (ii.) nuclei of the ramifications of the nerve and (iii.) nuclei of the sheath of Schwann covering the terminal plate. Sometimes a few nuclei may be made out in a sympathetic ending when seen in profile, presumably from Henle's sheath. Boeke[15] maintains that nuclei may be present, but the sarcoplasm is not heaped up. One of these myelinated motor fibres, as well as ending in an ordinary motor termination, gives off an unmyelinated collateral as at *F*, which ends in two thin fibrils terminating in three minute buds close to the proper end-plate. Being a teased preparation the connexion of this collateral with its nerve can be made out, but in thin paraffin sections this might easily be mistaken for a sympathetic ending which it resembles. The end-plate *H* is not in the striated muscle fibre con-

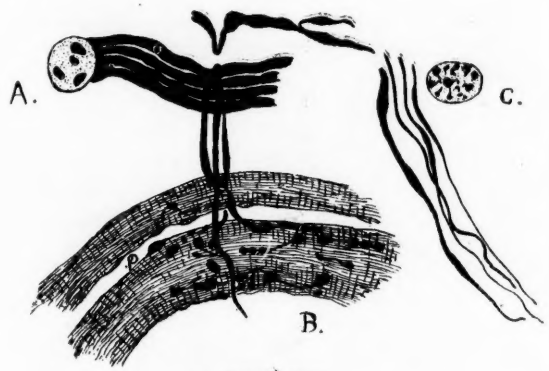

FIGURE VIII.
Somatic motor ending fowl's wing muscle, from myelinated nerve.

taining at *E* a non-myelinated nerve ending; when viewed through a binocular microscope it is recognized as being in a tag of muscle on a different plane. At E^1 a non-myelinated fibre ends in delicate buds and also sends a fine filament along a row of nuclei which may represent a capillary or a sheath of Henle. Thus in this preparation we do not find *terminaisons en plaques* on the same muscle fibres as *terminaisons en grappes* nor have we found them in any other specimen either from a bird or a goat; Kulchitski records the same findings. It must be admitted that one must be careful about dogmatizing, since gold impregnation often leaves many muscle fibres apparently without either sort of ending and only a fraction of the length of any striated muscle fibre is visible in any one preparation.

Generally a nerve holding myelinated fibres sends out more or less directly a ray of myelinated fibres ending quite soon in typical hypolemmal end-plates and carrying the myelin sheath right up to the end-plates. On the other hand we occasionally encounter a plexus of non-medullated nucleated nerve

FIGURE IX.
Sympathetic and somatic motor nerve endings, striped muscle fibres of goat.

fibres which branch, join again and again branch and, proceeding far through the muscle between the bundles, give off here and there apparently fine and coarse fibres which passing on to the striped muscle fibres either end in typical *terminaisons en grappes* or, after giving off these, pass long distances along the muscle fibres to join other similar nerve fibres at the other end. The difference between the two systems therefore is manifest and the latter conform in their nucleated non-myelinated structure, plexiform nature and absence of the nodes of Ranvier to sympathetic nerves. The fact is that groups of striated muscle fibres supplied entirely by one set or the other, medullated or non-medul-

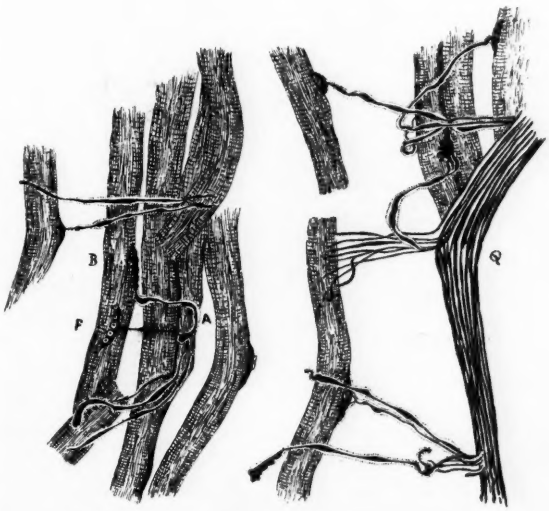

FIGURE X.
Somatic motor endings in striped muscle of goat.

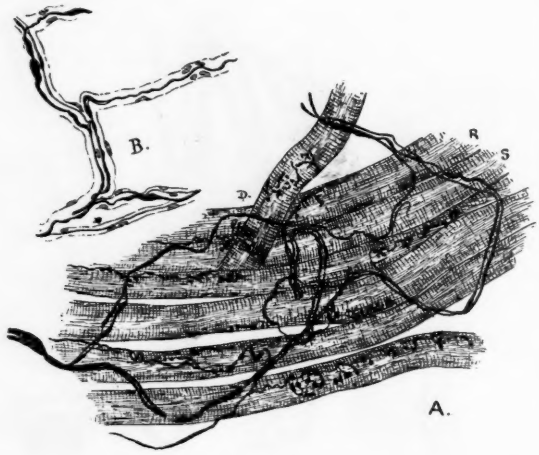

FIGURE XI.
Coarse and medium nerve endings from unmyelinated nucleated nerves in plexus formation, goat's striped muscle.

lated, are usually found. During the teasing one kind with its nerve fibre and end-organ may be dragged into the other group, but commonly the groups remain separate. Boeke[14] and other experienced workers show in their clear diagrams of Bielchowski paraffin sections

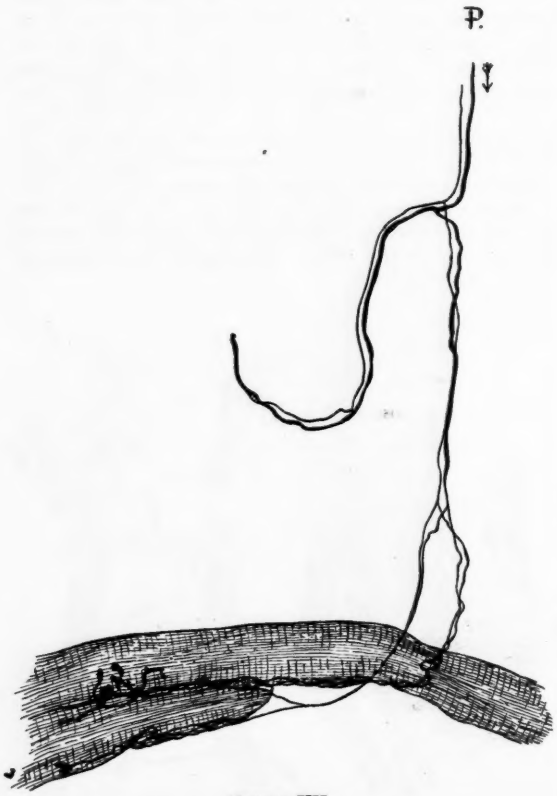

FIGURE XII.
Sympathetic nerve showing peculiar type of division, goat.

a fibre and an ending homologous with the sympathetic system, terminating in the same muscle fibre and near the motor end-plate and periterminal network. It is not so clear in these diagrams what becomes of the long sympathetic endings common in striated muscle fibres of the goat. Kulchitski believes that the muscle fibres receiving motor end-plates are thicker than those receiving grape-like endings. It seemed probable that sympathetic endings took place in the fatter, paler fibres; the method of impregnating and squeezing the fibres, however, introduces a possible source of error and it is therefore unwise to do more than allude to this aspect.

Figure X. is from the *levator palpebræ* of a goat. The specimen was impregnated with gold and teased in glycerine. Comparing this figure containing only coarsely medullated motor nerve fibres and hypolemmal end-plates with Figue XI. which contains

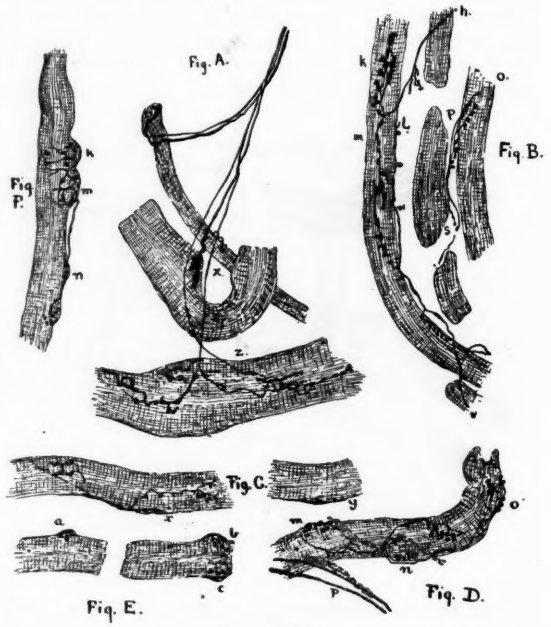

FIGURE XIII.
Types of sympathetic (?) nerve endings in striped muscle of goat, teased, gold impregnation.

only non-medullated nucleated nerves in plexiform formation and grape-like terminations, all supplying striped muscle, the characteristic difference between the two systems may be seen at a glance. This plate is chiefly interesting because at *A* a myelinated fibre ends in its sole plate at *B*, but gives off a non-medullated collateral which has an even larger accessory end-plate exhibiting nuclei of the granular bed. Here again a teased preparation allows us to trace its connexion with certainty. We have not yet encountered the ultra-terminal fibres.

Figure XI. is also a picture of the *levator palpebræ* of a goat. The specimen was impregnated with gold and teased in glycerine. It contains a group of seven striped muscle fibres all of which receive a variety of *terminaisons en grappes* from

a plexus of non-myelinated nucleated nerves; one part at *B* where the nucleated sheath of Henle is rather conspicuous, has been drawn at twice the magnification (750 diameters). It is not easy to decide how far coarseness and fineness in these nerves and nerve endings may be due to a different intensity of impregnation. At *D* the nerve endings are beneath the fibre *D* and belong to the muscle fibres *R* and *S*.

Figure XII. is a drawing of a *levator palpebræ* of a goat which has been impregnated with gold and teased in glycerine. This preparation shows a coarse and fine non-medullated fibre. Wherever one divides, the other does so too, so that each of the two new nerves contains a fine and a coarse fibre. They ultimately end in typical fine terminations on the muscle fibres. Has this anything to do with differences in function? In the claw muscle of the lobster two nerves with different function divide in a similar manner[24] and proceed to striped muscle, each muscle fibre receiving a coarse and a fine nerve fibre.

Figure XIII. depicts the *levator palpebræ* and external rectus of a goat. The specimen was impregnated with gold and teased in glycerine. It represents a set of drawings of terminations in striated muscle of non-medullated nucleated nerves to show variety of endings.

Generally such endings may be grouped as coarse and relatively discrete and delicate and spreading out, with variations between the two. The former naturally create more of a hump when viewed in profile and sometimes collect sufficient gold to simulate a sole-plate. It cannot be denied that they sometimes appear to be hypolemmal. The latter scarcely show themselves in profile and appear to be epilemmal. At *A* a leash of non-medullated fibres sends one fibre down to *z* where it forms a medium, delicate, spread-out type, while another fibre is much coarser and ends at *x*. This is a coarse, contracted end-organ. Sometimes the latter, when examined in profile, appear to be rosette shaped and not unlike a miniature *terminaison en plaque*. At *B* non-medullated fibres form a plexus, taking the course *h*, *g*, *w*, *v*, *o* and *s*; at *g* they give off some delicate, free filaments, possibly to connective tissue. At *k* they give off branches ending in large, coarse, clover-like terminal expansions, while at *m* delicate buds appear on the main stem, the fibre continuing till it meets other similar fibres. At *p* and *s* these branches with buds appear to have been torn off the sarcolemma, if they had not always this position. The latter type of termination is the only kind we have ever succeeded in teasing off the sarcolemma.

In *C*, at *x* and *y* the finer types of endings scarcely rise above the surface of the sarcolemma, while in *D* at *m*, *n*, *o* each little bud-like termination produces its own elevation. This would, one would suppose, indicate an epilemmal position.

In *E*, at *a*, *b* and *c* miniature humps on the muscle fibre are seen; if the impregnation is deep, the whole hump appears to be a sympathetic nerve ending, but if less deep, as may readily be seen at *b*, the muscle substance may be recognized through the nervous elements. Whether these eminences are artefacts or not, remembering the softness and swollen nature of the fibres in glycerine, we cannot say, but they certainly resemble minute eminences of Doyère and are possibly hypolemmal. They are not caused by pulling on the nerve endings, for in *F*, at *k*, *m* and *n* the non-medullated nerve fibres run along on the sarcolemma. Boeke mentions the presence of supernumerary humps without endings on them in the intrinsic eye muscles of birds, but not on the extrinsic muscles. One wonders whether these differences are associated with varieties of function. It remains to be insisted on that these so-called sympathetic endings keep within the confines of the muscle fibres they are supplying for the moment. Large, spreading, coarser maiden-hair-like endings spreading over numerous fibres and apparently in the connective tissues, have been noted by us, but they could readily be traced to myelinated nerves. Dogiel has pictured these. While muscle spindles were readily seen in paraffin sections stained by ordinary methods, we failed to make them out by this method.

Returning to the subject of the possibility of being able to separate histologically by means of the type of nerve supply and end organs the bundles of muscle fibres which might subserve different types of reaction, contractile and plastic tone, Bayliss has an interesting paragraph in which he alludes to the difficulty of understanding how the elements of contractile and fixing tonus subserved in bivalves by two different muscles and in the auricle of the tortoise by two different muscle fibres, should be combined in one muscle fibre only, as has been unanimously accepted for striped muscle of higher vertebrates.

The idea of a muscle being composed of innumerable bundles or units, each possessing one or other property, contractile and plastic tone, one supplied by the myelinated nerves and the other by the unmyelinated nucleated system, would greatly simplify our task if it could be proved.

Richet, Biederman and Mangold have demonstrated that two types of nerves go to the claw muscles of the lobster and each of these subdivides in such manner that a branch of each goes to each muscle fibre. Slow, weak stimulation produces different forms of contraction to more usual methods of excitation, even allowing that such a striped muscle fibre may represent the fusion of several muscle cells.

Other views on this question may be quoted. Botassi and de Boer hold that the sarcoplasm performs the function of prolonged contraction, the fibrils of the muscle fibre, quick contraction. Langelaan like Boeke believe that somatic motor nerve fibres terminate in the anisotropic discs and that the unmyelinated sympathetic nerve fibres terminate in the sarcoplasmic mass in which the striped apparatus is imbedded. Grutzner fancies that in skeletal muscles one set of fibres forms an intrinsic support for those fibres which are in active contraction, while in quite a recent paper Teigs advances the interesting theory that the muscle fibre striations are not discs placed transversely, but

exist in the form of two closely wound spiral bands (helicoids) reaching from one end of the fibre to the other, that Krause's membrane is similarly constructed. Having examined preparations of the claw muscles of the lobster and noted the parallel division of the two types of nerve mentioned above, he believes that "the two nerves end upon two adjacent striations of each muscle fibre."

And lastly Mr. Murray, one of our research scholars in zoology, during an investigation on the motor end-organs in the frog and dog-fish, using a modified Bielchowski technique, recognized in four instances in the striped muscles of frogs very fine fibres, apparently non-medullated, ending in little loops and nets on muscle fibres in which he could not find typical somatic motor endings and from which they differed greatly. In his opinion they were sympathetic and they were hypolemmal. We have to thank Mr. Murray for access to his private notes and literature, representing much material not otherwise available in Australia.

Conclusions.

We have been able to satisfy ourselves by using the gold impregnation method that, quite apart from their vascular supply, the striated muscle fibres of the hen and goat, animals used in experimental researches on the nervous mechanism subserving plastic tonus, have a rich supply of peculiar nerve endings derived from mixed nerves and plexuses of non-medullated nucleated sympathetic nerves, quite distinct from the end-plates derived from myelinated somatic motor nerves, that as far as our work goes these two types of nerve terminations *en grappes* and *en plaques*, do not exist in the same muscle fibres, but each supply separate groups and that we have found little evidence incompatible with the theory that these striped musculatures are divided into alternate groups of muscle fibres served respectively by branches from the somatic and sympathetic nervous systems, the former subserving contractile and the latter plastic tonus.

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Memorial Ceremony.

JOHN IRVINE HUNTER.

THE members of the New South Wales Branch of the British Medical Association met at the B.M.A. Building, 30-34, Elizabeth Street, Sydney, on December 18, 1924, to pay homage to the late John Irvine Hunter.

Tribute from the Victorian Branch.

A letter was read from Dr. J. W. Dunbar Hooper, the President of the Victorian Branch of the British Medical Association:

DEAR DR. TODD: I happened to be in the chair at our Council meeting last night when the news arrived of the death of Professor Hunter in London from enteric fever. I immediately told the members and tried to express to them and for them the intense sorrow we all felt at the passing of a genius who had already, though still very young, shed eternal glory on Australian medicine and research. His visit here during the Congress, quite apart from his wonderful lectures and papers which were indeed epoch-making, was rendered memorable by his genial, unspoiled character, by his fervid enjoyment of happiness. To his widow we tender our deep sympathy. He will be greatly missed in Sydney and at your meetings, but none of you will ever forget the glory he brought to Sydney. I cannot resist writing to you for I was profoundly impressed when, the men standing, we tried to convey to your Branch something of what we all felt.

Yours very truly,

J. W. DUNBAR HOOPER.

12, Collins Street, Melbourne,
December 12, 1924.

A Motion of Appreciation and Sorrow.

DR. ANDREW DAVIDSON, President of the New South Wales Branch of the British Medical Association, said:

We have met this evening so that we may place on record our deep sense of loss in the untimely death of Professor John Irvine Hunter. He was a great scientist. His industry was invincible. He was a genius with an infinite capacity for taking pains. He had the power to put anatomy on a sure foundation and thus gave to the study of surgery and of pathology their true place. He loved his work and in his incessant industry laboured as if life were too short (as it proved to be) for the work he had to do. His life was a sacrifice to science. "Out of his work, out of his discoveries came and will come health and safety and length of days and delivery from pain." His earnest aim and intense and beautiful character made him to all of us a guide, philosopher and friend.

I have now to move this motion which will be seconded and supported by Professor Mills, Professor Sandes and Acting-Professor Maguire.

We, the members of the New South Wales Branch of the British Medical Association, at this meeting in memory of John Irvine Hunter, desire to commemorate in pride and thankfulness his scientific achievement which has been the glory of medical science in Australia and holds incalculable promise for the future relief of human suffering.

We recall with feelings of personal gratitude the active part he took in the help of the profession by generous communication of his knowledge and ideas to practising members.

We express our deep and lasting affection for the noble qualities of his nature which bound all to him in friendship as intense as their admiration of his genius.

And we respectfully and sincerely offer to his wife and his mother and family the assurance of our sympathy in the measureless sorrow of their bereavement.

PROFESSOR A. E. MILLS said:

By his tragic death the University of Sydney has lost her most gifted son, science one of her most brilliant votaries and investigators and we who knew him, mourn the loss of a lovable and wonderful friend.

From far and near have come messages extolling the work accomplished by this young scientist. By common acclaim he had already become one of the foremost anatomists and investigators of the world and he had gained this unique position at the early age of ~~twenty-six years~~. It seems incredible and inexplicable, but we must ever remember that John Irvine Hunter was a genius and the capacity of genius is not to be measured by ordinary standards.

From the time he entered the University until his untimely death he went from success to success. Almost all the scholarships and prizes that were available, came to him during his undergraduate days. Yet he was neither recluse nor bookworm; he loved the companionship of his fellows and so found time to take a prominent part in the corporate life of his college and the University.

Of independent spirit and unwilling to be a drain on the slender resources of his family, he supported himself during his medical course by coaching his fellow students less gifted than himself. His success in this capacity was so great that he had to refuse applications from students wishing to join his classes and for reasons that strikingly proclaim his honesty of purpose. He felt that he could not do justice to his students if the classes were unduly large. With his studies, his teaching, his participation in various phases of student life, one would think his time was more than filled, but in his final year, the most strenuous of the medical curriculum, he wrote an essay which won for him Professor Sandes's prize. The title of this essay was: "Abdominal Pain: An Explanation of its Reflex Phenomena." Surely a difficult subject for anyone to treat, but student John Hunter was equal to his self-imposed task. Masterly was his treatment of the subject, thorough was his understanding of it. To use a favourite expression of his, it was "a definite contribution to knowledge." To me it gave clear evidence of extraordinary mental powers and great imagination.

As was anticipated with such a brilliant record, John Hunter graduated with first class honours and first of his year. None of his fellow students were envious of his great success. All felt proud that they had been associated with him. All realized that he had shed great lustre on the students of the fifth year of 1920.

In common with generations of students passing through their medical course, John Hunter at an early age came under the inspiring influence of Professor J. T. Wilson. It was his influence that induced John Hunter to forego the practice of his profession and take up a scientific career. It was largely his influence, too, that induced the Senate of the University of Sydney to appoint a graduate of only a few months' standing to the position of Associate-Professor of Anatomy. Never has the Senate made a wiser decision; never has it made so unprecedented a decision; never has a decision been so amply justified. And so for more than a year Associate-Professor John Hunter taught and worked and carried on the traditions of the

Department of Anatomy so firmly established by Professor Wilson.

Despite his onerous and exacting duties the spirit of research urged him to take up original work. We find him engaged in subjects of embryological significance such as a case of twin pregnancy and a case of ovarian pregnancy, the latter a piece of exceptional merit which was later published in *The British Journal of Anatomy*.

It was at this time, too, that Hunter commenced his investigations into transverse lesions of the spinal cord. In conjunction with Dr. Royle he carried out many experiments to elucidate the symptomatology of this condition and the results obtained added much to our knowledge and greatly clarified our understanding.

Realizing how important it was that Professor Hunter should see other seats of learning and work with other anatomists, the Senate, acting on the suggestion of Professor Wilson, gave leave to Hunter to pursue his studies abroad. For sixteen months he worked in England and Holland, in England chiefly with Elliot Smith and in Holland at the Brain Institute at Amsterdam under the guidance of Ariëns Kappers, the celebrated Dutch anatomist. Influenced by Elliot Smith, he became interested in anthropology and undertook the reconstruction of the Piltdown skull. Let me quote from a letter received from Elliot Smith about this time:

> I wonder do you realize what a genius you possess in Johnny Hunter. To me his help has been invaluable. He has completed many pieces of work that I had begun and had not found time to finish. . . . Hunter's work on the reconstruction of the Piltdown skull has set at rest the bitter controversy that has raged for years round these ancient remains. His demonstration before the Anatomical Society of Great Britain on the skull as reconstructed by him, was a masterpiece and was infinitely better than I could ever have given.

While working at the Brain Institute in Amsterdam he undertook at Kappers's suggestion a detailed examination of the brain of the kiwi. This work which was afterwards presented as a thesis for his M.D. degree and declared by Professor Wilson and his co-examiners to be of such merit as to be placed in the first class, has greatly increased our knowledge and has given us new views of the *corpus striatum*, views which were at variance with those previously held by Ariëns Kappers, but since accepted by him.

About this time I received letters from both Elliot Smith and J. T. Wilson recommending that Hunter should on his return to Sydney be appointed Professor of Anatomy in his old University. Both these eminent scientists stated their belief that there was no one among the younger school of British anatomists so well qualified for the position as he.

After a year's work in Britain and Holland Hunter went to America and Canada, visiting the great medical schools and becoming acquainted with the leading anatomists and physiologists of those countries. His fame had already preceded him as a result of the work that he had done previously in Australia, England and Holland. Applications to address meetings at various seats of learning poured in upon him, far too numerous for him to accept. Nevertheless, despite his limited time he gave many addresses on anthropological and neurological subjects and, as I afterwards learned from Professor Elliot Smith, wherever he lectured he made and left a wonderful impression.

Unspoiled by fame and by the applause and praise of eminent men, he returned to his old University in February, 1923, to take up his duties as Challis Professor of Anatomy in the University of Sydney at the early age of twenty-five years.

We soon realized the amazing development that had taken place in him. He had become a lecturer and a demonstrator of the foremost rank. The lectures and the demonstrations that he delivered were unsurpassed. Whether he was addressing scientific bodies or students or a lay assembly, he held his audience spellbound by his thorough knowledge and clear exposition of the subject he was dealing with.

It was at this time that he commenced in conjunction with Dr. Royle his epoch-making researches into muscle tonus. By a series of masterly and well devised experiments he showed conclusively that muscle tonus was a function of the sympathetic, a problem that had baffled the most eminent investigators. The results of these experiments were so convincing and so conclusive that Dr. Royle, assited by Professor Hunter, applied the knowledge thus gained to cases of spastic paralysis in man with the most gratifying results.

You will remember the wonderful addresses and demonstrations given by Professor Hunter in Melbourne; you will call to mind other addresses here and at the University, all dealing with various phases of the subject of muscle tonus, all showing his complete mastery of his subject and his unbounded enthusiasm.

It was while carrying out these researches that he gave evidence of another phase of his genius. For the next few months probably more research was going on in his department than in any other department of the University, for he had gathered around him a body of research workers and laboratory assistants all imbued with the same spirit to pursue truth and to advance knowledge for its own sake. Never had a chief a more loyal band of workers. All were eager to help, for all felt it was an honour and a privilege to be associated with him and to work with him and for him. He was always so gracious, so appreciate of the work of others, so modest concerning his own. He was of all men I have ever known the most lovable and the most loved.

In July last, when the delegates from the American College of Surgeons visited our University, they were so struck with the work done by Professor Hunter and Dr. Royle that they paid them the great honour of inviting them to deliver the Doctor John Murphy Oration for the year 1924. Truly a great honour, but one richly deserved.

In September Professor Hunter left these shores, alas, to return no more!

In the words of Milton, slightly altered, well may we say:

> John Hunter is dead: dead ere his prime.
> Young Hunter! and hath not left his peer.

PROFESSOR F. P. SANDES said :

Friends! How can I speak to you of John Irvine Hunter, whom we loved as one of our own for his singleness of purpose, his loftiness of ideal and his modesty in achievement? How can any man do justice to the life and work of him in whom we took such pride because he brought to Australian science such honour in the eyes of the world? How little we thought as he left on that fatal journey that never more should we gain inspirations from his eloquence? And yet, with the shock of his death still upon us and railing at the all-wise Providence that has dealt us this blow, we must try to assess his virtue amongst the anatomists of his time and to examine the factors that in a few short years placed him in such an exalted position in the world of biology.

Anatomy is a science whose disciples may be known by the influences brought to bear upon them in their youth. The young graduate who comes back to the dissecting room when his apprenticeship to medicine is over, is plastic material for the potter to mould. John Hunter with his splendid native ability was fortunate that even in his student days he came under the influence of a master whose whole-souled devotion to the science of anatomy and whose reverence for truth were an inspiration to all who worked with him. Nor can any man whose heart is true, survey minutely the structure of the human body or, for the matter of that, of any living thing, without becoming fascinated by its exquisite mechanism. Urged on by his ardent wish to know, enthralled by the prospect of devoting his life to unravelling the mysteries of Nature, the love of anatomy gripped the very soul of him who is now gone from us.

Anatomy itself is like a goodly tree. Even within the memory of many of us, it has given to science offshoots that have grown to the size of the parent, so that specialization has become inevitable. The memory of some of us, too, takes us back to the palmy days of the University of Edinburgh, when her Chairs were filled with a galaxy of talent, probably never paralleled in any university in the world. In anatomy the personality of William Turner and the attainment of his pupils in Chairs of Anatomy throughout our Empire, were potent factors in keeping Britain to the fore. Before the Great War her great opponents were the philosophers of the German school and the strenuous yet friendly rivalry between British and continental anatomists during the last quarter of last century, added enormously to our knowledge of different branches of biological science. America stood by and waited. She was merely biding her time.

In recent years, however, the more brilliant of our younger men have not looked with favour upon an anatomical career and this for various reasons. They might have to wait a long time for preferment. The constant teaching and examining, the burden of administration, the lack of equipment and opportunity for research, the hope deferred made the heart of the anatomist sick. As he plodded on in the dreary round and the common task he saw his fellow graduates prospering exceedingly, because they applied their talents in other ways.

Even before the Great War, so marked had this neglect of anatomy become that Britain was compelled to recognize that the expert dissecting room teacher whose specialized visual and auditory memory and descriptive capacity rendered him a much prized assistant to a professor, might be of little value when promoted to a chair. He had the dry bones of anatomy, but he could not make them live.

In consequence she had to call upon her dependencies where there had flourished men who might be regarded as anatomists, because of their comprehensive grasp of one or other of the great branches of biological science, because of their driving power, originality and capacity for research, or because they possessed the genius to attract, inspire and guide others who might take their places in the days to come.

But America was in the race. She had drawn largely from the Continent and occasionally from Britain. With the downfall of Germany her prospect of anatomical rejuvenation seemed to be fading. True, she had done her best to absorb the German complement in one branch of anatomy, namely cytology, in which America probably leads the world today. Nevertheless, as the result of her post-war advantages she was in the position to draw upon the world for her requirements.

In John Irvine Hunter Australia possessed a partially unfolded flower that might become the future glory of British anatomy. Australia might come again to help the mother country. Though others perhaps coveted our precious possession, Britain felt that his heart was true and hoped that in due time he might be hers. She had tested him once and rejoiced in the newly discovered jewel. With perhaps a lingering doubt, she would speak to her wise men, that they should test him again. If it could be, that this modest youth had the quality that she desired, she would call him to become her own and honour him beyond our conception.

But it was not to be. It almost seems as if Dame Nature, viewing from afar off this noble youth entering her domain, took thought to herself and fixed him with her regard. Watched him, resentful perhaps at his inquiring here, observing there and approaching the hidden place wherein she was enshrined. Fearful perhaps that he might draw aside the veil or wrest from her a secret that she would ever hide, did she summon to her aid the Fates that hold the threads of life?

ACTING-PROFESSOR F. A. MAGUIRE said:

John Irvine Hunter's career and scientific achievements have been reviewed by the mover and

seconder of the motion. It falls to my lot to touch a more intimate note and to give a tribute to the man himself as a comrade and a friend. It has been my great privilege to be very closely associated with John Hunter for the past five years. I well remember the first information I received of him. On returning to the Department of Anatomy in 1920, I asked Professor Wilson who was this man Hunter of whom one heard so much. I shall never forget the emphasis with which the Professor replied: "Maguire, he is worthy to bear the name of John Hunter." This judgement given by one so well qualified to judge and who always weighed his words, has been fully justified as is now well known. From that time on we were closely associated. One was quickly and deeply impressed by Hunter's tremendous enthusiasm. He threw the whole of his energy into his work and delighted in tackling problems. He was in his position of Associate-Professor in close contact with both the staff and the students and he was respected, admired and loved by all. He was always so approachable that one would find students coming to him at all hours with their difficulties and problems. Many times has one seen him lay aside his own work at a moment's notice to help one of his students who was in difficulty or one of his colleagues who desired his advice or guidance. Hunter's perception was so quick and his knowledge so deep and wide that one always received helpful advice which was given with such good will and enthusiasm that one felt inspired. That was the keynote of his influence—inspiration. It radiated from him in the lecture room and the laboratory. He worked for the joy of seeking after truth and time was as nothing to him. He would come up to the School at all hours, at night time, week ends or holidays, to watch for himself the progress of his experiments. At one time he was interested in the segmentation of the ovum and the production of monsters by the disturbance of the segmenting mass. He had a tank full of frogs' spawn and he watched the development of those eggs day and night. On many occasions he stayed up most of the night and watched by the tank for some manifestation that he was looking for. One week end I had occasion to call at the School on Sunday morning and found him alone working on a rabbit investigating the nervous control of the alimentary tract. I know that he spent many week ends in this way. His capacity for work was tremendous and always filled us with astonishment. His keenness and delight on obtaining a result were most exhilarating. So it was with every problem which he took up.

While perhaps his greatest interests lay in the realms of neurology, he was strongly attracted by every branch of anatomy and its parent subject, biology. No matter in what branch of anatomy the members of his staff were working, they always found in Hunter a keen and helpful critic. To his fellow workers he was always most generous, ever ready to applaud a piece of good work, quick to appreciate a difficulty and inspiring in suggesting further lines of research. He always urged the great importance of the literature of the subject and the necessity for consulting original authorities. Indeed, Hunter felt keenly the lack of a well organized reference library in Sydney and hoped to devote time to the organization and extension of the facilities for reference to original authorities.

Hunter was very versatile in his interests. Outside the Department of Anatomy he was interested in University affairs, both administrative and undergraduate; he followed the sports and competitions in season and was an ardent admirer of our great athletes. He read widely and was well versed in art, music and the theatre. And it will interest many to know that he held a commission as Lieutenant in the Australian Army Medical Corps and fully intended to take up active work in the Defence Forces on his return from abroad next year. It was one of his great regrets that he was not on active service abroad in the Great War, but he did not graduate until after the war was over. Indeed, it was only with the greatest difficulty that he was held back from enlisting while an undergraduate.

To those who knew him intimately he was a most lovable character, utterly unselfish, modest in everything and thought of himself last at all times. He was roused to enthusiasm by anything that interested him, but he was at his best when driving home the points of his argument. Opposition stirred him to his greatest heights and he brought to bear all his energies and wonderful faculties to prove his points. Those who knew him best, would realize the great strain his recent tour must have thrown on him, for he went forth as a prophet among the unbelievers. Those were the conditions that inspired him to his utmost effort and speaking under the stress of high nervous tension, he was always transfigured by the fire of his genius. This is the impression of John Hunter that his friends will always carry in their minds and hearts. Cut off as he has been in his youth, just as he was receiving world-wide recognition, he has left a great gap among us. But the inspiration of his brief but brilliant career and of his great genius will stay with us all our days. How well do the words of Robert Louis Stevenson describe his passing: "In the hot-fit of life, a-tip toe on the highest point of being, he passes at a bound on to the other side. The noise of the mallet and chisel is scarcely quenched, the trumpets have hardly done blowing, when, trailing with him clouds of glory, this happy-starred, full-blooded spirit shoots into the spiritual land."

THE PRESIDENT put the motion; all those present gave their silent assent standing with heads bowed.

WE regret that Dr. N. D. Royle is not yet sufficiently recovered from his illness to submit his tribute to his lamented colleague.

Reprints of Memorial Speeches.

THE above record will be reprinted in suitable form together with the portrait of John Irvine Hunter which appeared in our issue of December 20, 1924. Copies of the pamphlet will be offered to members of the medical profession at one shilling. Those requiring copies should apply to the office of THE MEDICAL JOURNAL OF AUSTRALIA, 30-34, Elizabeth Street, Sydney.

The Medical Journal of Australia

SATURDAY, JANUARY 10, 1925.

A Retrospect.

Medicine.

THE year 1924 has witnessed much ingenious work having for its object the elucidation of numerous unsolved problems in medicine. Many important contributions to knowledge have been published and while there have been no very great discoveries, the advance has been at least as rapid as in the immediately preceding years.

Although in the past some highly interesting observations have been made in regard to the physiology and pathology of the thyreoid gland, clinicians have been inclined to correlate some frequently associated conditions and goître without producing any definite evidence of a causative nature of the association. Recently David Marine and others have submitted the doctrines of the ætiology of simple goître, exophthalmic goître, cretinism and myxœdema to a searching inquiry and have applied physiological experiment to the endeavour to illumine the problem. The suggestion that endemic goître is a water-borne infection must be relinquished. There is apparently no foundation for this belief. Similarly the thesis that endemic goître and Graves's disease are in some inexplicable way produced by the effect of some distant infective focus, lacks all scientific support. Marine has shown that these diseases are dependent on a deficiency of iodine, be it as a result of an increased demand for the substance called thyroxin or of an interference with the absorption and utilization of iodine taken in with the food or of a restriction of the iodine supplied to the body. The iodine deficiency leads to a thyreoid hypertrophy which is followed by a hyperplasia. If the deficiency is extreme, atrophy results, while if iodine is supplied at the stage of hyperplasia the gland passes into a colloid condition. It is admitted that the ætiology of Graves's disease is much more complex than the mere deficiency of iodine, but it has been shown that the disturbance in metabolism is related in some way to an augmented thyreoid gland activity and that the deficiency of iodine is part of the cause. Iodine and iodides are given with good results in simple and exophthalmic goître, as well as in cretinism.

A mass of publications on diabetes and its treatment with "Insulin" has appeared during the last twelve months. Many facts have been recorded, but the whole story of the ætiology of diabetes has not yet been told. In England greater caution is being displayed in the exhibition of "Insulin" and it is becoming increasingly evident that blood sugar estimations are essential.

L. H. Newburgh and Sarah Clarkson have advanced strong experimental evidence to prove that diets with a high protein content produce injury to the kidneys in lower animals. They suggest that while it has not yet been demonstrated that the lesions of chronic nephritis in man are due to the action of excessive quantities of animo-acids, it is dangerous to treat nephritics with diets containing considerable quantities of proteins.

As time goes by the number of tests suggested for the estimation of the renal function increases. The majority are too complicated for practical use. None of the new tests have been adopted in general practice during the year.

George F. Dick and Gladys H. Dick have isolated a hæmolytic streptococcus from patients suffering from scarlatina. With one strain they succeeded in producing scarlet fever experimentally. They claim that the isolated streptococcus fulfils Koch's postulates and is therefore to be regarded as the cause of scarlet fever.

The rival hypotheses concerning the ætiology of *angina pectoris* have again been exploited and fresh light has been shed on the problem. The doctrines favoured up to the present are that it is a manifestation of coronary disease, that it is a disease of the supra-sigmoid region of the aorta, that it is the result of cardiac failure and exhaustion and that it is produced by intoxication of the myocardium by incompletely eliminated fatigue products. K. F. Wenckebach has offered support to Clifford Allbutt's view that it is a lesion of the supra-sigmoid

region of the aorta and argues that *angina pectoris* is relieved and not caused by cardiac failure. He regards the changes in the coronary arteries and in the myocardium as secondary. He has suggested section of the nervous tract which conveys the afferent impulses from the proximal part of the aorta. T. Jonnesco resected in 1921 the cervical sympathetic and the first thoracic ganglion, but Wenckebach has insisted that it is only necessary to bisect the depressor nerve which issues from the superior laryngeal nerve or from the vagal trunk. Daniélopolu has opposed the other hypotheses in favour of the intoxication theory. He has recommended section of the sympathetic chain.

V. J. Kinsella has published an instructive discussion on the ætiology of œdema in this journal. The arguments represent the views of Professor A. E. Mills. According to this doctrine œdema is due either to increased permeability of the capillary walls resulting from oxygen deficiency of the intimal cells or to an altered state of nutrition of the tissues.

B. J. Clawson has claimed that the common causative organism of sub-acute bacterial endocarditis is the *Streptococcus viridans,* while that of acute bacterial endocarditis is *Streptococcus hæmolyticus.* He maintains, however, that the acuteness of the infection does not depend on the organism, but on the resistance of the individual. The vegetations are thrombi, often producing ulceration of the valves. In rheumatic endocarditis the valves are the seat of inflammatory vegetations of a proliferative type.

Further data have been collected of the occurrence of latent syphilis. The serum of many persons who have never manifested any signs of the disease, reacts to the Wassermann test. The French and American authorities are now confirming the findings of Fairley and Fowler of 1921.

The perennial dispute concerning the justification for the removal of tonsils, post-nasal vegetations and other lymphoid tissue in the treatment of nephritis, Sydenham's chorea, cardiac disease, exophthalmic goître and other affections, has continued unabated. K. H. Digby has issued a warning against the indiscriminate sacrifice of the sub-epithelial lymphatic glands, on the ground that the tonsils, Peyer's patches, solitary lymph glands and *appendix veriformis* possess strong immunizing action against bacteria.

A. A. H. Van den Bergh and J. W. McNee have shown that the reticulo-endothelial system has as one of its functions the formation of bilirubin. It has been demonstrated that so-called "latent jaundice" may occur in pernicious anæmia and hepatic cirrhosis. The Van den Bergh test for bilirubin is receiving an increasing amount of attention, although the general practitioner apparently has not yet adopted it in his practice.

Much has been written on pulmonary tuberculosis. New methods of palpation are being employed in diagnosis. It has been suggested that there is a reflex cause of the wasting of muscles in pulmonary tuberculosis acting through the spinal arc. Treatment by the production of artificial pneumothorax is gaining adherents in other countries, although this method has but few adherents in Australia.

A. Wilson and N. W. Winkleman have described a form of peripheral neuritis resulting from carbon monoxide poisoning.

Surgery.

During the past twelve months relatively few important advances have been made in the realm of surgery. Surgical technique continues to improve and as each device is made known and is applied by many operators, better results are achieved. Skill, although still important, was even more so in the pre-anæsthetic and pre-aseptic days. Ingenuity and resource are probably more valuable attributes in a surgeon today, while a wide knowledge of contemporary work is essential. The best surgeons of today are not merely artists with the knife; they are expert pathologists and keen clinicians. It is one of the most notable indications of the progress in surgery that its practitioners recognize the value of medical treatment and apply it in their practice.

The ingenious work of N. D. Royle of performing ramisection for spastic paraplegia and a few other affections of the brain and spinal cord, has been extended and has gained general acceptance. Reference is made in another chapter to the researches of the late John Irvine Hunter; they

have an important, but indirect reference to surgery. The invitation to both Royle and Hunter to deliver the Dr. John B. Murphy oration in New York in October, 1924, is evidence of the recognition of the value of the work of both.

The question of the treatment of gastric and duodenal ulcer still gives rise to much difference of opinion. Many surgeons of great eminence claim that medical treatment of gastric and duodenal ulcers is too uncertain and too slow and therefore that surgical treatment is imperative. Some still perform gastro-jejunostomy; some have discarded all short-circuiting operations. Others again cauterize the ulcer; excision by one of many methods is favoured by many of the leading surgeons. Sherren, Mikulicz, Devine, Kocher and many others have established special operative procedures which yield good results and which are not merely "one man" operations. Partial gastrectomy by the Pólya method is being carried out on the Continent by many authorities. Billroth's first method is favoured by Mayo. D. C. Balfour has contributed an instructive paper on this subject in which he describes the several methods employed at the Mayo Clinic.

Another problem in surgery that has been a source of divergent views is that connected with the surgical treatment of infection of the bile system. W. J. Mayo recommends cholecystectomy when the gall bladder alone is infected. When the common duct is involved, he prefers cholecystostomy, at all events as a preliminary procedure. Prolonged drainage apparently enables the patient's general condition to improve.

Arthur Keith has put forward some admirable work on the origin of herniæ. He has found that developmentally an umbilical hernial sac is formed and persists to within a week of birth. The sac sloughs and a cicatrix forms around its mouth, so that spontaneous reduction occurs. Later, a fresh peritoneal pocket may form in response to stretching and the hernia then assumes pathological qualities. A similar explanation is given for inguinal hernia. The testis is incapable of withstanding the high degree of intra-abdominal pressure. By following the process of the descent of the testis into the scrotum, Keith has shown how the developmental aspect plays the most important part in the formation of a hernial sac. He maintains that the actual hernia is caused by repeated minor impulses rather than excessive intra-abdominal pressure.

The position of the appendix has been studied by R. J. Gladstone and C. P. G. Wakeley in an endeavour to improve the diagnosis and treatment of lesions of this organ. They have found that in nearly 70% of persons the appendix lies behind the caecum or behind the colon. In 27.5% of persons it is situated in the pelvis. Only rarely is it pre-ileal, post-ileal or sub-caecal.

Much attention has been paid to the various aspects of the cancer problem. In England a coordinated effort is being made to gain a mastery over the disease. The public has become concerned and has contributed generously towards the movement. The tendency appears to be to concentrate effort to a large extent on a study of the action of X-rays on the cells of the various forms of malignant growths. In many centres it is held that the information to be gained by a study of the transmission of natural and artificial carcinomata of mice has led to a dead end. Some very ingenious research is being carried out on the subject of cell culture and the mystery of the disorderly overgrowth of cells in cancer is being attacked from the cellular point of view. Some excellent work in this direction has been carried out by T. F. P. Murray and I. M. Mackerras at the University of Sydney. Professor Brailsford Robertson has endeavoured to revive the plan of campaign of von Hansemann and has put forward some interesting hypotheses based on observations on the growth of the cell. In Sydney a special cancer research committee has been formed and funds are being collected to enable the committee to inaugurate an organized effort to discover a cure or to learn how to prevent the disease. The study of the pathology of malignant disease is being continued in Melbourne by the Sir John Grice Cancer Research Scholar. It would seem that a very great deal of serious research is being carried out in all parts of the world by competent workers and it is there-

fore not unreasonable to anticipate that material progress will be made in the near future. Whether or not these energetic efforts will reveal the nature of the cancerous diseases remains to be seen. It is not scientifically sound to seek a cure before the ætiology has been mastered.

Gordon Cameron has made a special investigation of a series of cases of carcinoma of the pancreas and has extended the knowledge concerning the clinical manifestations, sex, age and racial distribution and situation of the tumour. He has found that epigastric pain and loss of weight are the commonest signs of the disease; jaundice, enlargement of the liver and palpable tumour are also common signs.

Pædiatrics.

Pædiatrics is defined as that department of medical science which relates to the care of children and the treatment of their diseases. In order to determine the delimitation of this department, it becomes necessary to define the term children. The care of infants is not usually regarded as a function of the pædiatrician, but is left to the obstetrician for reasons of convenience. On the other hand the diseases of infancy are included in pædiatrics. A restriction of this kind, as well as that encountered by the ill-defined transition from childhood to adolescence, renders a logical distribution of scientific work difficult. Some overlapping is inevitable.

Some important work on pneumococcal infections in children has been published by Reginald Webster during the year that has just closed. In his first paper he has recorded the results of a study undertaken with the object of ascertaining the incidence of the several types of pneumococci in these infections. He has found that the distribution follows closely that observed in relation to lobar pneumonia of adults in the same locality. Type I. pneumococcus occurs with approximately the same frequency in Australia, England and America, Type II. pneumococcus is relatively uncommon in Australia and the heterogeneous group is correspondingly large. Webster considers that the routine treatment with serum of lobar pneumonia in children, is unncessary. He has shown, however, that the crisis occurred within twenty-four hours of the injection of the serum in five out of seven children affected with lobar pneumonia due to Type I. pneumococci and that it followed immediately when a second injection was given in the other two. In his second article Webster has demonstrated that contact infection with Type II. pneumococci occurs between mothers and their babies and that the mother acts as a carrier of this pneumococcus for a period of at least twenty-one days.

Kirkwood, Myers and Lumsden have made an interesting contribution to the possible causes of inspiratory apnœa in the newly born. Lumsden has investigated the brain stem of an infant. In the light of his recent researches on the respiratory centres of the cat, he has been able to demonstrate the cause of apnœa in this patient. Minute hæmorrhages were found, the position of which determined the onset of the apnœic type of respiration. This is characterized by alternating periods of inspiratory tonus and gasping.

Much work has been carried out by George F. and Gladys H. Dick on the ætiology of scarlatina. These investigators have claimed that hæmolytic streptococci of two cultural types used in their experiments are the causal organism of the disease. They have put forward the claim that the filtrate of the broth culture of the streptococci contains a soluble toxin and that when suitable quantities of this toxin are injected into susceptible persons, the rash and the characteristic symptoms of scarlet fever are produced. They have further claimed that susceptible persons yield a specific reaction when this filtrate is injected into the skin. They have endeavoured to immunize persons held to be susceptible on account of the skin reaction by injecting small doses of the filtrate. They have claimed to have effected an immunization in this way; the persons so treated no longer reacted to the filtrate and did not subsequently contract scarlet fever after exposure to infection.

Dochez and Sherman have described an antistreptococcic serum for use in the treatment of scarlet fever. The Dicks have also produced a serum for which they have claimed antitoxin action. They have employed this serum therapeutically in the disease. They have made no claims concerning its therapeutic value, as they consider that it will

be necessary to await the results of its use in a large series of carefully controlled infections.

Rogatz has carried out a series of studies on the function of the stomach of infants. Normal infants were examined with X-rays at regular infants before and after meals and observations were made concerning the form, size and position of the organ, the presence of the "air bubble," the type of peristaltis and the emptying time. A further series of observations was made in order to determine whether or not there existed a peristolic function of the stomach of infants. Rogatz has concluded that this function is present and that it has an important practical significance which can be exploited in the treatment of pyloroplasm and habitual vomiting.

The treatment of epilepsy in children by diet has received a considerable amount of attention. Three years ago Wilder suggested the use of ketogenic diets for this purpose. His interest in the subject had been aroused by the favourable results obtained by prolonged fasting as carried out by Geyelin. One of the metabolic irregularities accompanying fasting is the accumulation and excretion of aceto-acetic acid and its products, β hydro-butyric acid and acetone. Wilder then suggested that instead of fasting, ketogenic diets might yield similar results. Peterman has put the method to a practical test. Twenty children of ages ranging between one year and fifteen years have been given a ketogenic diet and in addition four patients have received "Pheno-Barbital." He has not formed a final opinion concerning the value of this method of treatment. A trial on a large scale is needed before its value can be estimated. This is essential on account of the wide variations of time intervals between the attacks and also because so little is known concerning the cause of the epileptic affections.

Noeffel and Moriarty have studied the metabolism of two children with epilepsy while they were undergoing fasting for prolonged periods. They have noted a considerable reduction of the alkali reserve and a measurable increase in the hydrogen ion concentration of the blood. In addition there was an increased excretion of ammonia and of the titratable acid bodies of the urine and a decrease in the sugar content of the blood. As soon as the fasting was discontinued, the conditions returned to normal. There was noted a distinct but temporary amelioration of the epileptic symptoms.

Morphology.

A medical journal addressed primarily to general practitioners cannot be utilized to a large extent for the purpose of conveying information concerning anatomical and morphological investigations. Within recent years we have included morphology among the subjects in the section of the journal devoted to abstracts of articles from current medical literature, because of the great importance of these studies to the problems of every day clinical medicine. The space devoted to this science is necessarily restricted. No attempt is therefore made to embrace anatomical and comparative anatomical work carried out all over the world.

One of the most important matters to which we have to direct attention is the gift by Professor W. Colin MacKenzie of his magnificent collection of specimens and animals to the Commonwealth of Australia and the passing of a special Act of Parliament accepting the gift of the National Museum of Australian Zoology and the appointment of the donor to the position of director with the title of Professor of Comparative Anatomy. Although the Museum has not yet been moved to its permanent home in Canberra, it is already the property of the Commonwealth and the work of Professor MacKenzie has now assumed a national character.

Reference has been made in another chapter to the remarkable work of John Irvine Hunter on the sympathetic innervation of striped skeletal muscles. Some admirable studies have been completed by T. K. Potts on the sympathetic ganglia in man.

Of late the œstrus cycle of mammals has attracted many workers. Some interesting investigations have been published in connexion with the cycle in the mouse and the opossum.

Ossification has been the subject of study from several points of view. Some fresh information has been forthcoming in regard to the differences in the time of appearance of ossific centres and in the rate of ossification in male and female human beings.

Abstracts from Current Medical Literature.

THERAPEUTICS.

Calcium in Nephritis.

N. M. KEITH, C. W. BARRIER AND M. WHELAN (*The Journal of the American Medical Association*, August 30, 1924) reported two patients with nephritis and œdema treated by calcium administration. They also discussed the literature on the subject. Various observers have noted that large doses (ten grammes daily) of calcium chloride were followed by diuresis and subsidence of œdema in patients with nephritis. Both the patients reported by the authors had sub-acute nephritis and œdema. They were given ten to eighteen grammes of calcium chloride daily, in one case for four days and in the other for twenty-six days, with intermissions. Urinary output increased, œdema disappeared and weight fell to normal. Low protein diet (forty grammes) and low water and salt intake were also given. Blum explained the diuretic effect of calcium chloride by its effect on retained sodium; he believed œdema to be due to sodium retention; calcium as well as potassium produced a loss of sodium which carried with it water. It appeared that after the administration of calcium chloride the calcium was eliminated by the bowel and the chlorine absorbed, this became attached to the retained sodium and passed into the urine allowing the escape of water. Haldane and his coworkers noted an acidosis after calcium chloride administration, the chlorine being absorbed as hydrochloric acid while the calcium passed out by the bowel as calcium carbonate. They also noted diuresis, fall in alveolar carbon dioxide and increased excretion of sodium, ammonium and total acids in the urine. These observations were confirmed in part in the authors' two patients.

Stokes-Adams's Syndrome.

J. PARKINSON AND C. BAIN review the literature and give the details of a case in which the administration of adrenalin relieved attacks of heart block of the Stokes-Adams type (*The Lancet*, August 16, 1924). The patient lost consciousness and fell on several occasions. His pulse rate was twenty-eight and there were ventricular pauses lasting as long as six seconds. During the height of the attacks 0.6 mil of adrenalin chloride (1 in 1,000) was administered hypodermically and the pulse rate rose to one hundred within twelve minutes. These procedures were repeated on several occasions, each time adrenalin abolished the heart block for several hours, but the heart returned to a slow rate again. Eventually the attacks ceased and the patient was well six weeks later. On pharmacological grounds adrenalin might be expected to be useful in Stokes-Adams's attacks. It can facilitate conduction when partial block is present and it can increase the rate of a dissociated ventricle. It is not claimed that adrenalin cured heart block, but the authors consider that it is worth a trial for the purpose of relieving attacks of Stokes-Adams's syndrome.

"Dialectin."

S. H. HALL (*The Lancet*, August 16, 1924) records some results of the treatment of epilepsy with "Dialectin," a combination of "Dial" with allyl-paracetamino-phenyl. Cushny recommends this drug. Each tablet contains 2.7 grammes of the former and 10.2 grammes of the latter constituent. Half a tablet twice daily is a good initial dose. Other drugs should be gradually discontinued. "Dialectin" often succeeds when bromides and "Luminal" fail. The dose of "Dialectin" should be increased till it produces the required results, cessation or great diminution of the epileptic seizures. It is particularly useful for patients whose attacks occur in cycles and an endeavour should be made to forestall the attacks and control them by "Dialctin." The usual dietary and hygienic management of epilepsy is required and the drug is most useful as an adjuvant to this and to bromides.

Bismuth Treatment of Syphilis.

E. HOFFMANN (*Klinische Wochenschrift*, August 19, 1924) gives the results of his experiences with bismuth in the treatment of syphilis. He considers that its spirochætal action is better than mercury, though not as good as "Salvarsan." Time alone will tell whether it can supplant mercury regarding the permanence of the effect. The injections are painless and complications very rare. A course consists of ten to twelve intra-muscular injections twice a week. He is not in favour of its use intravenously, though he has combined it with intravenous injections of "Salvarsan." Primary sores disappear in one or two weeks and the secondary manifestations of the skin and mucous membranes up to a fortnight. The effect on the response to the Wassermann test is very slow. Good results have been obtained in the early stages of the disease and also in late ones if complicated with visceral lesions. In the latter bismuth should be combined with iodides. Early *tabes dorsalis* and other meta-syphilitic infections have not yielded good results. It can replace mercury in the treatment of congenital syphilis, especially when combined with "Salvarsan." The dose must be reckoned on the weight of the infant, 0.002 gramme of metallic bismuth to each kilogram. Larger doses cause diarrhœa. For pregnant women he recommends a combination of bismuth and mercury.

Paravertebral Injections for Angina Pectoris.

F. BRUNN (*Wiener Medizinische Wochenschrift*, September 13, 1924) gives the history of a patient in whom he severed the depressor fibres in the neck for angina. There was no recurrence of symptoms for six months. As the condition became as severe as before, he made a paravertebral injection of 0.5% solution of "Novocain." in the first and third dorsal segments. The patient was free from attacks for eleven days and eight months later had only two minor attacks.

Prophylactice Use of Iodine for Goître.

H. ZELLER (*Klinische Wochenschrift*, September 23, 1924) gives the results of small doses of iodine in school girls with thyreoid enlargement. One thousand two hundred and sixty girls were observed and to eleven hundred and forty-two 0.3 milligramme of iodine was given in tablet form each week by the teacher until eight milligrammes had been taken. The circumference of the neck was taken as a guide to the effect of the treatment. The average size of the neck in a normal girl was between thirty-nine to forty-one centimetres. One hundred and thirty-two girls served as controls; forty-one showed a decrease, thirty-eight an increase and in seventy-three the size of the neck remained the same. Increase or decrease less than two or three centimetres was ignored. Goître-free girls were those in whom no enlargement of the thyreoid could be seen and no definite mass palpated. Of those taking iodine eight hundred and forty-two were examined; in three hundred and three there was a decrease, in two hundred and seventy-seven an increase, whilst in two hundred and sixty-two no change was detected. Thyreoid enlargement with cystic changes reacted in various ways and no definite rule could be formed. In conclusion he states that while he considered that small doses of iodine had an inhibitory action of thyreoid enlargement, a critical survey of his observations makes him rather dubious. Further investigation is necessary before this conclusion can be safely drawn.

UROLOGY.

Radiographic Features of Urinary Calculi.

H. P. W. WHITE (*The British Journal of Surgery*, July, 1924) presents a special study of the relationship of the chemical and physical structure of urinary calculi to their radiographic appearances. The higher the atomic weight of a substance, the denser is the skiagraphic impression. But the depth of the shadow thrown varies also with the physical density of the calculus and, of course, with its actual thickness. Various kinds of calculi were cut down to form cuboidal pieces of five millimetres high and were submitted on the same plate to the same exposure of X-rays. The poorest shadow was obtained with uric acid and was almost undiscernable on the print. A poor show was

obtained with triple phosphate stones; this is to be expected from the relatively large amount of ammonium they contain and from its low atomic weight. The shadow of triple phosphate stones indeed was due to small amounts of calcium salts. Extremely poor shadows are obtained with cystine and xanthine stones alone, but shadows are seen on the plate because of the presence of some calcium. With the remaining stones, of calcium phosphate and calcium oxalate respectively, deep shadows of almost equal quality were obtained. An equally good shadow is obtained with calcium carbonate. If urinary calculi are sectioned after removal from the body the original nucleus can often be seen, especially in vesical calculi. When layers of different chemical composition have been laid down during formation, these are clearly seen on section and in good radiograms lighter or darker streaks and areas are proved to correspond with the chemical variation. In studying the question in connexion with radiograms made on the patient, renal and ureteric stones should be considered separately from those of the bladder. Exploratory operation for stone is rarely justified when stone has not been found by radiographic examination. It is a curious fact that uric acid stones in the ureter hardly ever become impacted, but pass on into the bladder. This may be due to their relative smoothness. With these eliminated, it follows that practically all stones resting or impacted in the ureter should be demonstrable in a good radiogram. Radiograms sometimes fail to demonstrate calculi in the bladder consisting largely of uric acid or ammonium urate, but cystoscopy removes the diagnostic difficulty.

Median Extra-Peritoneal Approach to the Ureter.

K. W. MONSARRAT (*The British Journal of Surgery*, July, 1924) emphasizes the advantages of a median suprapubic incision for exposure of the whole length of the pelvic part of the ureter. It may be necessary to extend the incision up to the umbilicus. When the extra-peritoneal plane is reached, the peritoneum is reflected medially from the side of the pelvic basin and held back by means of a broad retractor. The ureter is easily found on the peritoneum. After the operation on the ureter is concluded, drainage is secured by drawing a half-tube through a stab wound made on the side medial to the anterior superior iliac spine. The usual inguinal incision is more useful for operations on stones arrested at or just above the pelvic brim, but the median incision gives superior access to the ureter in its course through the true pelvis.

X-Ray Diagnosis of Ureteric Calculus.

C. D. ENFIELD (*Urologic and Cutaneous Review*, May, 1924) describes a special manœuvre for aiding the diagnosis of doubtful shadows near the pelvic part of the ureter. With an opaque catheter in the ureter, the same plate is exposed twice to X-rays, but before the second exposure the X-ray tube is moved transversely about five centimetres. The shadow of a ureteric calculus will coincide with that of the catheter in both positions.

Bacteriuria.

H. G. GREDITZER (*Journal of Urology*, February, 1924) discusses the origin and the treatment of the various forms of bacteriuria. The condition seems to be an infection differing only in degree from the ordinary infections in that obvious signs of inflammation in some part of the genito-urinary tract are absent. When bacteriuria is persistent, there is some focus of the infection in the upper or lower portions of the urinary tract. It may be the initial or terminal stage of pyelitis, cystitis or urethritis. It may result from typhoidal or other general infection, instrumentation, stricture, gonorrhœa or prostatic hypertrophy. Rarely, fever accompanies the bacteriuria and blood culture may yield a growth of *Bacillus coli*. Symptoms referred to the urinary tract are absent. A complete examination of the genito-urinary tract should be made so that the point of origin may be determined. The prostatic and vesicular secretions should be expressed and examined. When, by the use of the ureteric catheters, bacteria are found coming from the kidneys, antiseptic instillations into the renal pelvis should supplement the prostatic and vesicular treatment which is usually required. In one instance the author achieved success by injecting into the renal pelves a suspension of living *Bacillus bulgaricus*.

Resection of the Renal Nerves in Nephralgia.

E. PAPIN AND L. AMBARD (*Journal of Urology*, April, 1924) present a new treatment for the commonly observed, but ill-understood, painful conditions of the kidney grouped under the term nephralgia. They resect all the nerves running with the renal blood vessels along the main pedicle or occasional accessory vessels. The nerves all belong to the sympathetic system and are the only nerves leaving the kidney. They claim that there is no lasting effect upon the renal secretion or the integrity of the gland to be noticed after the resection.

Fascia Lata Transplant in the Urethra.

E. C. BRENNER (*Journal of Urology*, February, 1924) records a successful operation for the restoration of the urethral lumen by means of a *fascia lata* transplant. The patient was a boy of four and a half years. Three months previously the urethra had been torn at the time of a fracture of the pelvis. An external urethrotomy had been performed and a suprapubic deviation of the urine had been carried out. The suprapubic fistula and two centimetres of the urethra immediately in front of the membranous portion were replaced by dense scar tissue. The latter was excised and a catheter passed in a retrograde way along the urethra. On this a piece of *fascia lata* was sewn to form a tube and the ends of the tube were then sutured with fine chromacized catgut to the vesical and penile ends of the urethra. The suprapubic cystostomy wound was closed up and the catheter retained in the urethra for twelve days. The result, three months after leaving hospital, was excellent.

Exact Diagnosis in Bladder Rupture.

R. T. VAUGHAN AND D. F. RUDNICK (*Journal of the American Medical Association*, July 5, 1924) discuss the differentiation of extra- and intra-peritoneal rupture of the bladder. They advocate the injection into this viscus of air with the patient under constant fluoroscopic control. Usually fifty to five hundred cubic centimetres of air are ample. The air is injected through a catheter by means of a hand bulb. In intra-peritoneal rupture the air bubble is free to move to the highest point in the peritoneal cavity. Thus it appears floating on the surface of the intestinal mass just beneath the peritoneum of the abdominal wall when the patient is recumbent. When the patient is made to sit up, it rises to the anterior and superior surfaces of the liver. In extra-peritoneal rupture the air escapes into the loose perivesical areolar tissue and spreads slowly along the fascial planes outside the peritoneal cavity. When there is no rupture, the air indicates clearly the normal outline of the bladder. There is no discomfort in the procedure and no added risk of air embolism or infection.

Radium in Carcinoma of the Prostate.

R. H. HERBST (*Journal of the American Medical Association*, May 17, 1924) classifies prostatic carcinoma as follows: (i.) Scirrhous cancer beginning in the postero-inferior portion and tending to form metastases early *viâ* the main efferent lymph channels to the pelvic glands; (ii.) a combination of benign hypertrophy of the antero-superior portion with carcinoma of the postero-inferior part; (iii.) adeno-carcinoma, the least common, in which the entire gland is involved. This type is smooth and symmetrical as a rule, but is harder than the ordinary innocent adenomatous enlargement. The author advocates radium treatment, but only if bony metastases are absent. First, the bladder is opened above the pubes and radium needles are embedded under the posterior part of the trigone so as to lie just behind the prostate and between the seminal vesicles. It is in this region that the efferent lymphatic trunks from the prostate are situated and this technique secures their early blockage. At the same time a benign hypertrophy of the antero-superior part of the gland, if present, may be removed. At a later operation radium needles are embedded into the malignant mass itself by perineal approach.

British Medical Association News.

MEDICO-SOCIAL.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held in the hall of the Victorian Artists' Society, Albert Street, East Melbourne, on November 26, 1924, at which DR. J. W. DUNBAR HOOPER, the President, unveiled a portrait of Sir George Syme by Mr. John Longstaff and presented a copy of the portrait to Lady Syme.

DR. J. W. DUNBAR HOOPER said that the Council of the Victorian Branch of the British Medical Association had called the members together to witness the work of Mr. John Longstaff in an oil painting of Sir George Syme, which they purposed later to place in their new hall. Sir George Syme had decided on July 1, 1924, to retire from active practice, but had decided also to their great pleasure and benefit to maintain his interest in medical education, in preventive medicine and in all that helped to improve the public health of the whole community. While he enjoyed excellent physical health and abundant mental vigour, they thought that this was the right time at which the artist might catch the familiar features of their friend. For the benefit of generations to come they desired that this portrait should be placed on the wall of the Council room and that the members might often be inspired by the remembrance of his quiet dignity, his unassuming demeanour, his sterling character, his ripened thought expressed in words of wisdom and caution; and furthermore that they and those to follow them might ever remember the integrity of character, the unselfishness of purpose of the upholder of sound surgery and of the highest ethics of their profession.

On behalf of the members, Dr. Hooper cordially wished Sir George Syme continuance of good health, the company of many friends, the surroundings of a happy family life and the knowledge that, having devoted himself as a student and as a surgeon to the hard work and honour of the profession, he had lived to reap the confidence not only of his colleagues, but of the whole community.

They purposed also to establish the George Adlington Syme Prize in clinical surgery, details concerning which would be announced latter.

As Sir George Syme had interested himself in so many directions, it was but right that he should ask representative men from each of these activities to speak of their knowledge of Sir George Syme. He would then call upon Dr. E. H. Sugden, Dr. Bernard Zwar and Dr. Murray Morton to speak.

Turning to Lady Syme, Dr. Hooper said that they were glad indeed to ask her acceptance of a replica of the portrait painted by the distinguished Victorian artist, Mr. John Longstaff, that in her home she might ever have a remembrance of the high honour which her husband had attained in his native land and from the members of his loved profession. This portrait they hoped, whenever seen by her and by her children, would be a reminder to the family of the long and noble service which Sir George Syme had rendered to his profession and the community. He expressed the hope that they might be spared many years to enjoy the peace and honour of his hours of leisure.

THE REVEREND DR. E. H. SUGDEN, Master of Queen's College, Melbourne University, said that owing to the unavoidable absence of Sir John MacFarland, the Chancellor, and Sir John Monash, the Vice-Chancellor, he had had a measure of greatness thrust upon him in that the privilege of speaking on behalf of the University Council fell to him. Sir George Syme had been a useful, diligent and honoured member of the University Council for a period of twelve years and was held in the highest esteem by all the members of the Council. They valued his matured judgement not only in matters relating particularly to the Medical School, but on questions affecting the general policy of the University. He took pride in the fact that he could count Sir George Syme as a personal friend. At Queen's College he had been for many years in close contact with medical students and in the free intercourse of college life had become acquainted with the students' estimates of their teachers. While appreciating or otherwise the quality and methods of his instruction, the student also divined the personal and moral attributes of the teacher and he could say that in both respects Sir George Syme had always enjoyed the highest regard of his pupils.

It was not only in the Medical School of the University that Sir George Syme had won affection and esteem, for while no man had shrunk so much from publicity, no man had achieved a wider, more enduring or affectionate popularity.

On the occasion of the opening of the Australasian Medical Congress in 1923, he had been privileged to hear Sir George Syme's magnificent inaugural Presidential address, an address of profound spirituality and wisdom. Sir George had never allowed himself to be submerged by the wave of materialism which seemed to have engulfed many thinking people of late years, but had always maintained a fine ideal of the spiritual side of life. The whole community was his debtor for his splendid conception of duty; many of them whose family circles would have been broken but for the surgical insight and experience of Sir George Syme, owed him a deep personal debt of gratitude.

DR. B. T. ZWAR said that the duty with which he had been charged, though very pleasant, was one concerning which he felt it was very difficult to do justice. Speaking on behalf of the clinical school of the Melbourne Hospital, he desired to pay a tribute to the enduring impression of Sir George Syme's influence upon the teaching and the training of medical students and medical men in the State of Victoria and in the Commonwealth. Sir George Syme's longest and closest professional association had been with the Melbourne Hospital, where he had been a resident surgeon as far back as 1882 and a member of the honorary staff, a clinical teacher and a lecturer and examiner in surgery from 1887 to 1919, a period of thirty-two years. The record of his service there, in itself a monument, was well known to all.

He wished, however, to beg permission briefly to refer to the final period of Sir George's work at the Melbourne Hospital. During that time he (Dr. Zwar) had had the privilege of corresponding to him in the Out-Patient Department. His time had then been fully occupied on account of the service he was giving to returned soldiers. Yet amidst his multifarious duties he had rarely failed to answer an emergency call to the hospital or to attend one of the various meetings of the staff; at the same time he had been able to keep abreast of advances in surgical science and to lead the way in their application. That Sir George was able to do this had always appealed to him as the greatest tribute to the genius and characteristic of the man.

As the result of his association with the Melbourne Hospital the sphere of Sir George Syme's influence had become greatly widened through the teachers at other clinical schools who had been his students and had imbibed his ideals which embodied the principle, to use his own words: "Clinical work is the crown of the whole system of medical education."

At least equal to his services in the interests of clinical teaching was the lasting influence of Sir George Syme's ideal upon the medical graduates of the Melbourne University and of the Commonwealth. To advance medical knowledge, to maintain or even raise the honour of the medical profession, were ideals which he had fostered with enthusiasm and carried out with unselfish devotion. He had done his utmost to instill these ideals into his students and members of the medical profession.

Dr. Zwar expressed gratification that medical students and members of the medical profession of future days would be reminded of the ideals, the devotion and the influence of the man, by the splendid work of the artist.

DR. D. MURRAY MORTON said that he deemed it a great honour, as a member of the honorary medical staff of Saint Vincent's Hospital, to have been asked to join in the expression of the high esteem in which all held Sir George Syme. His personal association with Sir George Syme had begun in his student days and had continued during his term as resident medical officer at the Mel-

bourne Hospital in the early 'nineties. On joining the staff at Saint Vincent's Hospital he had had the good fortune to become the junior corresponding surgeon to Sir George Syme, to whose wisdom and sagacity and sound surgical lore he owed a very great deal.

Sir George Syme had been one of the first surgeons appointed to Saint Vincent's Hospital; his high standard of technique and his high ideals of everything pertaining to the medical profession had left a stamp which still endured in the work carried on at Saint Vincent's Hospital. It was the laudable ambition of every younger surgeon to strive to reach the ethical and surgical standard set by Sir George Syme.

The good influence of such a man in their professional community could not be over-estimated and he was proud to be able to join in doing him honour.

SIR GEORGE SYME, in acknowledging the tribute paid him, said that he would be less than human, an insensate block, if he were not profoundly touched by the all too kind and flattering words of Dr. Dunbar Hooper, the Reverend Dr. Sugden, Dr. Zwar and Dr. Murray Morton. He wished sincerely to express his gratitude to those who had subscribed and to the speakers, although he felt that words were inadequate for the purpose.

His recent reading had embraced the "Journal of a Disappointed Man," written by an author who had adopted the pen-name of "Barbellion." That extraordinary record of minuteness and candour revealed great ambition for fame and applause and the clamorous desire of a man for the respect and good opinion of his fellows. If they disclosed their inmost thoughts and aspirations, would they not say: "Aren't we all?"

He confessed that he was pleased, proud and gratified by the tribute paid him by his colleagues. Whatever views they held regarding the dispensation of good or bad fortune in life, there were great differences in the fortunes of people as seen from the outside. He felt that he had been very fortunate. It was well for a man to say: "I am the captain of my soul," but there were factors in life over which he could not possibly exercise control. In his own case he had been fortunate in his parents, their training, example and inheritance and fortunate in his teachers. He had also been fortunate in his friends. He felt therefore that he could not take much credit to himself for the honoured position in which he found himself, but was afraid that he had been over appreciated.

It was difficult for a man to judge his own portrait. It had been said that the face seen by a man in a mirror reflected his conscious self, while the face as seen by others and portrayed by the artist, reflected the unconscious mind. Apparently they did not know what traits might be lurking in the sublimal consciousness to be brought out by some sudden stimulus. Viewing his portrait in the light of this dictum he was relieved to find it "not too objectionable."

MEDICO-POLITICAL.

Foundation of New Building.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held on November 26, 1924, on the site of the Medical Society Hall for the purpose of the laying of the foundation stone of the new premises of the Victorian Branch.

DR. R. H. FETHERSTON, Convener of the Building Sub-Committee of the Council, said that it was his pleasing duty to ask the President to place a commemorative marble in position in the new building. The old Medical Society Hall, to which they had been greatly attached, had been built in 1878 and the fathers of some of them had taken a prominent part in the activities which had gained the Hall for the Medical Society of Victoria. Unfortunately, when the building was demolished recently no marks or tokens commemorative of its foundation could be discovered, although very thorough search had been made. They were anxious that the present building should not be deficient in this respet. In 1878 the membership of the Medical Society of Victoria was approximately one hundred; at the present time the number of members was twelve hundred and their requirements demanded a larger and more commodious hall. The new building would provide them with a hall capable of seating over four hundred and with roomy libraries and offices.

The President, Dr. Hooper, would see that the stone was truly set and on behalf of the Medical Society of Victoria he had pleasure in asking him to accept a memento of the occasion.

Dr. Fetherston then presented the President with a spirit level artistically mounted as a paper weight.

DR. J. W. DUNBAR HOOPER, the President, said that the occasion marked the inauguration of the new building which was being erected for the Victorian Branch of the British Medical Association at the corner of Albert Street and Brunswick Street South, East Melbourne. Behind this piece of Buchan marble had been placed and sealed up a history of the Medical Society of Victoria, the names of all the members and office bearers, a copy of the last Annual Report, a photograph of the old building and the names of the architects and contractors for the new building. This marble gave the date of the commencement of this building, which was of reinforced concrete and therefore had practically no foundation stone.

The Building Committee was a continuance of other committees which had worked constantly for four years to select a suitable site, to endeavour to raise the necessary money and to choose the architect and builders. The whole Branch was greatly indebted to the Convener, Dr. R. H. Fetherston, who had put much thought, time and energy into the details of the building. He wished success to the architects and to the builders and felt sure that when the opening of the building took place in six months, they would then have something worthy of the Victorian Branch and worthy indeed of the city and community in which they lived.

He asked the members to be generous and speedy in raising the necessary debentures with which to carry on this important work. By this short function they desired to stimulate their interest in the work of the building and in the activities of the Council and to remind them of the value not only to the profession, but also to the community of the strength and influence of the British Medical Association.

The old building had many interesting memories for a past generation. There were some present whose fathers had inaugurated the Medical Society and had built the Hall just demolished. Many keen debates had taken place in the old building. Much of the scientific work reported there in papers and discussions had helped to make the high reputation of the Melbourne Medical School. In this building, whose inception they commemorated that day, the progress of medical and surgical research and practice would be eagerly discussed for the benefit of the profession and of the people of Victoria.

The stone, a handsome piece of Buchan marble, bears the inscription:

THIS MARBLE,
COMMEMORATIVE OF THE LAYING OF THE FOUNDATION
OF THIS BUILDING,
WAS PLACED IN POSITION BY
J. W. DUNBAR HOOPER, M.D., PRESIDENT,
26TH NOVEMBER, 1924.

NOMINATIONS AND ELECTIONS.

THE undermentioned has been elected a member of the Victorian Branch of the British Medical Association:

Grant, Memyss Gordon, M.B., B.S., 1924 (Univ. Melbourne), 30, Powlett Street, East Melbourne.

NEW YEAR HONOURS.

THE only medical practitioner in Australasia on whom His Majesty has conferred an honour at the beginning of the year 1925, is Dr. Frederick Truby King. He has been created a Knight Bachelor in recognition of his work in instituting the New Zealand system of child welfare. It is very gratifying to realize that services of this kind receive appreciation. We tender our congratulations to Sir Frederick Truby King.

Medical Appointments.

DR. WILLIAM GEORGE ARMSTRONG (B.M.A.) has been appointed a member of the Board of Health, Sydney.

* * * *

DR. ALFRED AUSTIN LENDON (B.M.A.) has been reappointed President of the Medical Board of South Australia.

* * * *

DR. IVAN BEDE JOSE (B.M.A.) has been appointed Honorary Assistant Pathologist, Adelaide Hospital, South Australia.

* * * *

DR. G. BURY has been appointed Medical Officer of Health of the Yilgarn Road Board, Western Australia.

* * * *

DR. C. D. KERR has been appointed Acting District Medical Officer and Public Vaccinator, Fremantle, Western Australia.

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DR. HAROLD AXEL HAIG has been appointed Director, Laboratory of Microbiology and Pathology, Department of Public Health, Brisbane, Queensland.

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DR. CLARENCE GEORGE GODFREY (B.M.A.) has been appointed a member of the Medical Board of Victoria.

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DR. GEORGE GRAY NICHOLLS has been appointed Assistant Government Medical Officer, Class "B," Professional Division, Victoria.

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DR. WHITFIELD DE WITT HENTY (B.M.A.) has been appointed Medical Superintendent of the Hospital for the Insane and the Receiving House, Royal Park, Victoria.

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DR. IAN MACNEIL has been appointed Certifying Medical Practitioner in the City of Ballarat, for the purposes of the *Factories and Shops Act 1915*.

Books Received.

"ONE YEAR": A PLAYLET IN TWO ACTS, by A. S. Vallack; 1924. Sydney: Radcliffe Press. Crown 8vo., pp. 38.

THE OFFICIAL HISTORY OF AUSTRALIA IN THE WAR OF 1914-1918: VOLUME II.: THE STORY OF ANZAC, FROM MAY 4, 1915, TO THE EVACUATION, by C. E. W. Bean; 1924. Sydney: Angus and Robertson, Limited. Demy 8vo., pp. 975, with 524 illustrations and maps. Price: 21s. net.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF GLYCOSURIA AND DIABETES, by Hugh Maclean, M.D., D.Sc., M.R.C.P.; Second Edition, Revised and Enlarged; 1924. London: Constable and Company, Limited; Sydney: Angus and Robertson, Limited. Demy 8vo., pp. 191, with thirteen charts and nine figures. Price: 8s. 6d. net.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF RENAL DISEASE, by Hugh Maclean, M.D., D.Sc.; Second Edition, Revised and Enlarged; 1924. London: Constable and Company, Limited; Sydney: Angus and Robertson, Limited. Demy 8vo., pp. 110, with four coloured plates.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF PULMONARY TUBERCULOSIS, by R. C. Wingfield, M.B., M.R.C.P.; Modern Medical Monographs, Edited by Hugh Maclean, M.D., D.Sc.; 1924. London: Constable and Company, Limited; Sydney: Angus and Robertson, Limited. Demy 8vo., pp. 134, with illustrations.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xvi.

ETHERIDGE DISTRICT HOSPITAL, GEORGETOWN, NORTH QUEENSLAND: Medical Officer.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429, Strand, London, W.C..

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 30 - 34, Elizabeth Street, Sydney.	Australian Natives' Association. Ashfield and District Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham Dispensary. Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney. Marrickville United Friendly Societies' Dispensary. North Sydney United Friendly Societies. People's Prudential Benefit Society. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association Proprietary, Limited Mutual National Provident Club. National Provident Association.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Brisbane United Friendly Society Institute. Stannary Hills Hospital.
SOUTH AUSTRALIAN: Honorary Secretary, 12, North Terrace, Adelaide.	Contract Practice Appointments at Renmark. Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (WELLINGTON DIVISION): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Diary for the Month.

JAN. 10.—Queensland Branch, B.M.A.: Council.
JAN. 10.—South Australian Branch, B.M.A.: Council.
JAN. 13.—New South Wales Branch, B.M.A.: Ethics Committee.
JAN. 14.—Tasmanian Branch, B.M.A.: Branch.
JAN. 17.—Northern Suburbs Medical Association, New South Wales.
JAN. 20.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
JAN. 22.—Victorian Branch, B.M.A.: Council.
JAN. 24.—Queensland Branch, B.M.A.: Council.
JAN. 27.—New South Wales Branch, B.M.A.: Medical Politics Committee; Organization and Science Committee.
JAN. 28.—Victorian Branch, B.M.A.: Council.
FEB. 3.—Tasmanian Branch, B.M.A.: Council.
FEB. 4 AND 5.—Federal Committee of the British Medical Association in Australia: Meeting at Melbourne.
FEB. 6.—Queensland Branch, B.M.A.: Branch.
FEB. 10.—New South Wales Branch, B.M.A.: Ethics Committee.
FEB. 12.—Victorian Branch, B.M.A.: Council.
FEB. 12.—South Australian Branch, B.M.A.: Council.
FEB. 13.—Queensland Branch, B.M.A.: Council.
FEB. 17.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
FEB. 17.—Tasmanian Branch, B.M.A.: Council.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor," THE MEDICAL JOURNAL OF AUSTRALIA, B.M.A. Building, 30-34, Elizabeth Street, Sydney. (Telephone: B. 4635.)

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